Final Draft Environmental Baseline Report

For the District of Columbia

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THE Louis Berger Group, INC.

DISTRICT DEPARTMENT OF TRANSPORTATION

DC OFFICE OF PLANNING

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ENVIROMENTAL BASELINE REPORT FOR THE DISTRICT OF COLUMBIA

1.0 INTRODUCTION

Washington, DC is a city that successfully balances the relationship between urbanized area and natural terrain. This distinction is due in large part to its unique environmental characterization: the District lies at the confluence of the Potomac and Anacostia Rivers between two separate physiographic regions, the Piedmont and the Coastal Plain. The city's western edge is bounded by the Potomac on the Piedmont Plateau and is characterized by escarpments, palisades, and gorges typified by the Palisades and Rock Creek Park. The southeast region of the District lies within the marshes, shallow inland bays, and meandering tidal rivers of the Anacostia and Coastal Plain. The convergence of these two landforms, their climate, and associated water resources, allows for a richness in both biologic values and natural aesthetics that in many ways match the historic, cultural, and social significance of the Nation's Capitol.

In 1791, Pierre L'Enfant laid out a plan for the District that capitalized upon the topographic variations in the natural landscape. His plan featured grand radial and diagonal tree lined avenues superimposed over a grid system. The intention was to visually connect ideal topographical sites throughout the city. He also designed a series of parks and ceremonial open spaces at the intersection of circles, streets, and boulevards. While these parks were integral to the character of the neighborhoods, they did little to contribute to a comprehensive park system for the city. As a result, the McMillan Commission[1] was organized to improve and expand the network of open spaces in the District. The 1901 McMillan Plan called for the redesign of the District's monumental core and established a comprehensive park and recreation system. The forested and open space parks system, which includes the Fort Circle Parks, Rock Creek Park[2], and various other community parks provide one of the District's most distinctive ecological assets. These parks and open spaces furnish a repository of natural species, associated habitats, and vegetative cover.

But despite the District's wealth of open space, it is also one of the nation's most dense urban areas[3] A thorough understanding of this land use pattern is essential to the protection of human health and the environment, and the improvement of urban quality of life. The District's population density and the associated land use patterns -- along with the age of its buildings and infrastructure and remaining environmental impacts from previous land uses – contribute to a number of environmental problems, including poor air quality, traffic congestion, noise, buildings and building sites compromised by hazardous materials and residual groundwater contamination, wasteful energy consumption, a large quantity of solid waste, the need for strict

[1] Senator James McMillan was the chairman of the Park Improvement Commission of the District of Columbia and founded the McMillan Commission.
[2] The Rock Creek Park is comprised of the main reservation as well as 99 other administered units throughout the city. These include triangular parks, community gardens, and other small area open spaces. There are approximately 2,200 acres of federal parkland in the District portion of Rock Creek valley.
[3] The 1995 Census rates DC as one of the top ten densest cities at 9,528 people per square mile.

control of hazardous chemicals and wastes to prevent injury and property damage, challenges to maintaining the quantity and quality of drinking water, increased urban runoff, tree cover loss[4], and the loss or degradation of ecological habitat.

Despite these problems, environmental quality has improved over the last few decades. Today, 20% of the city is now parkland, and in 1993, the World Resources Institute ranked the District as fifth[5] on their Green Metro Index, a study which scores metropolitan areas on air and drinking water quality, past and present toxic emissions, energy use for heating and cooling residences and commercial buildings, and transportation patterns.

While most cities and states in the nation have established departments of the environment to coordinate and enforce policies, the District has dispersed these responsibilities across numerous agencies, the primary environmental agency being the DC Department of Health's Environmental Health Administration. As a result of this dispersal of authority, environmental policies are, in many cases, not well known or compiled in a manner that provides a cohesive vision for environmental resource management in the District of Columbia. The District is in the process of establishing a cabinet-level Department of the Environment, which will become operational in 2006.

Regulating Agencies & Entities

Numerous district agencies and commissions, semi-autonomous regional entities, and nonprofit organizations have oversight on the District's environmental issues. *See Table 1.2- Interagency Responsibility- Environmental Matters.*

The following municipal agencies have primary responsibility for environmental matters in the District:

DC Department of Health, Environmental Health Administration (EHA)

The DC EHA is responsible for controlling and preventing environmentally related diseases as well as the preservation of the ecological system in the District. DC EHA has three bureaus: Hazardous Material and Toxic Substances; Environmental Quality; and Community Hygiene. The Bureau of Environmental Quality is comprised of four divisions: Air Quality, Fisheries and Wildlife, Watershed Protection, and Water Quality. The Bureau of Hazardous Material and Toxic Substances provides regulatory oversight and services relating to contaminated site remediation, underground storage tanks, hazardous waste, lead-based paint, pesticides, and radiation. The Bureau of Community Hygiene, which will remain in the DOH Health Care Regulation and Licensing Administration after the establishment of the Department of the Environment, provides regulatory oversight and services relating to animal welfare and control, animal disease prevention, rodent and vector control, food safety, and hygienic inspections. EHA also implements specific local policy pertaining to the District of Columbia Environmental

[4]According to American Forests, the city lost more than half of its heavy tree cover between 1973 and 1997.
[5] The Green Metro Index ranked Honolulu first, followed by San Diego; San Francisco/Oakland and El Paso tied for third.

Protection Act objectives, which are consistent with regional, state, and federal environmental policies, and seek to ensure that the environmental impacts of development projects are assessed and taken into account in local permitting decisions.

DC Department of Public Works

The DPW is split into two program areas: the first half encompasses environmental services and solid waste management and the second half is responsible for parking enforcement. The agency's Solid Waste Management Administration is responsible for trash and recycling collection, education and enforcement, municipal trash collection (in single family homes and multi-unit dwellings with less than three units), seasonal leaf collection, and street and alley cleaning. Responsibility for policy development relating to solid waste management and recycling will be transferred to the new Department of the Environment.

DC Department of Energy (DCEO)

The DC Energy Office serves as the lead agency responsible for ensuring an adequate energy supply to sustain the growth of the District's economy. The agency is responsible for promoting energy efficiency education and energy accessibility for low income customers. Administratively, the DCEO is lodged within the Department of Public Works (DPW). The Department of the Environment Establishment Act transfers DCEO to the new department.

DC Department of Consumer and Regulatory Affairs (DCRA)

The DCRA is the District of Columbia's regulatory agency, with oversight on licensing, inspection, permitting, compliance, and enforcement programs. DCRA also regulates zoning, land and building use and codes, and rental housing and real estate. This agency is comprised of three operating administrations[6] and several administrative support offices. The DCRA is responsible for enforcement of noise control and permit issuance on water and sewer excavation and solid waste facility operation.

District Department of Transportation (DDOT), Urban Forestry Administration (UFA)

The UFA is located within DDOT and is responsible for street tree[7] planting and maintenance. In response to the USDA Forest Service requirement, the UFA recently formed an Urban Forestry Technical Advisory Board (UFTAB) to allocate federal funds to local forestry projects. The UFTAB is comprised of professionals and citizens from DDOT, Green Spaces for DC, Greenworks, Metropolitan Washington Council of Governments (MWCOG), Urban Forest Council of Washington DC, and the Casey Trees Endowment Fund. Responsibility for establishing tree policy has been transferred to the new Department of the Environment.

[6] Building & Land Regulation Administration (BLRA), Business & Professional Licensing Administration (BPLA), and Housing Regulation Administration (HRA

[7] Street trees are trees located between the curb and sidewalk on all District-owned property

DC Department of Parks & Recreation (DPR)

The DPR maintains area parks, community facilities, and neighborhood recreation centers. DPR also coordinates a wide variety of recreational and educational programs.

The following entities and advisory bodies also have oversight on District and regional environmental issues:

Mayor's Environmental Advisory Council and Mayor's Environmental Task Force

The Mayor's Environmental Council is comprised of local environmental advocates and professionals. The Mayor also established an Environmental Task Force, comprised of the directors of District agencies that regulate environmental matters or that provide environmental services.

The Office of the Clean City Coordinator

The Clean City Coordinator serves as the central point of contact within the Office of the Mayor to maintain the cleanliness of the District of Columbia. The Clean City Initiative focuses on cooperation between agency department directors, intergovernmental entities, ANC, civic associations, and citizens regarding city standards relating to litter control, illegal dumping, sanitation, rodent harborage, abandoned vehicles, abandoned tanks, and waste prevention and education.

DC Council Committee on Public Works and the Environment

This Committee is responsible for matters relating to our transportation infrastructure, regulation of vehicles, maintenance of public spaces and facilities, water supply, wastewater, air quality; recycling and trash collection. The Committee has oversight on DPW, the Washington Aqueduct; the District of Columbia Taxicab Commission; the Bicycle Advisory Committee; the Soil and Water Conservation District; the School Transit Subsidy; the Environmental Policy Act; DCWASA, and the DC Department of Motor Vehicles.

Department of Environmental Programs at the Metropolitan Washington Council of Governments

This regional department focuses on environmental resources programs (air, noise, solid waste/recycling, and energy) and water resources programs (watershed, source pollutant analysis, wastewater management, water quality).

National Capital Planning Commission Council on Environmental Quality (CEQ)

The CEQ analyzes effects of proposed development on the environment in the region, ensuring compliance with the National Environmental Policy Act (NEPA).

Interstate Commission on the Potomac River Basin

The Interstate Commission on the Potomac River Basin (ICPRB) was established by Congress in 1940 to assist Maryland, Pennsylvania, Virginia, West Virginia, the District of Columbia, and the federal government in enhancing, protecting, and conserving the water and associated land resources of the Potomac River basin through regional and interstate cooperation.

DC Department of the Environment

Effective February 15, 2006, the District of Columbia established a new cabinet-level Department of the Environment, consolidating many of the District's environmental, energy, and natural resource programs. Programs and activities that provide direct services, such as trash collection and tree maintenance, will remain in their respective departments. The new department will include programs and activities relating to air quality; water quality and watershed protection; storm water administration; fisheries and wildlife; hazardous waste; underground storage tanks; contaminated site remediation; lead, asbestos, and pesticides regulation; radiation protection; coordination and lead agency status for environmental reviews; and policy development relating to trees, solid waste management and recycling, and vector control.

<u>The 1984 Comprehensive Plan</u>

The Environmental Features Element of the existing plan encompasses five distinct areas: Transportation (air quality & the production of alternative forms of transportation), Urban Design (low impact development, steep slopes, grading, protection of stream valleys, open space and landscaping), Downtown (sanitation), Economic Development (Brownfields), and Housing (energy efficiency). The eight ward plans also include additional policies on environmental protection. The majority of policies and action statements are applicable to the entire city, but there are numerous others that are geographically specific. On the whole, the District has made significant progress in addressing environmental goals, policies, and action statements initiated by the 1984 Comprehensive Plan. Both the District and regional entities have initiated programs and policies towards achieving better air quality, water quality, and solid waste and energy recycling and conservation.

A significant percentage of the previous environmental plan focused on achieving acceptable standards of air and water quality in the District. Since 1984, the District, Maryland, and Virginia have taken measures to reduce emissions and other sources of air pollution to National Ambient Air Quality Standards. The Washington, DC-MD-VA State Implementation Plan (SIP) of 1998 outlines the steps the respective governments will take pursuant to Section 110 of the Clean Air Act to reduce air pollution. Some of these steps include the installation of air quality monitors (Takoma Park, McMillan River Terrace, Alexandria, and Arlington) and the establishment of the DOH Bureau of Environmental Quality Indoor Air Quality and Radon activity to educate the public on the nature of radon and measures to mitigate exposure. The DC Water and Sewer Authority (WASA) has also aggressively implemented standards to achieve better water quality. WASA's primary goal is to replace 2,800 lead service pipes by 2007 in a program aimed at reducing the risk of lead contamination in drinking water. This program is

part of a larger initiative that encompasses the city-wide replacement of an estimated 23,000 lead pipes by 2010 at a projected cost of $300 million.

In the past 20 years, the District has successfully promoted more efficient use and management of nonrenewable energy resources and solid waste recycling through a series of incentives, initiatives, and mandates aimed at citizen and government agency participation, public outreach, and public education. In 1986, the District of Columbia Energy Office (DCEO) released the Comprehensive Energy Plan I (CEP I), the first initiative that promoted energy efficiency, aggressive use of renewable energy sources, and the adoption of legislative, administrative, and regulatory mechanisms to monitor and enforce better utilization of energy in the District. From 1986 to 1990, CEP I policies and recommendations achieved a 6% reduction in the total amount of energy consumed in relative to levels in 1982. While CEP II was never completed, CEP III was released in 2003, with an implementation schedule extending through 2007. This Plan promotes an increase in energy awareness and innovation, availability and affordability, and collaboration between public and private entities. Programs focused on city-wide recycling have enjoyed limited success. In 2002, Mayor Anthony Williams implemented a three-year timeline for all District agencies and facilities to achieve goals laid out in DC Code § 8-1006, a recycling target of 45% (by weight) for the separation and collection of recyclable paper for the total solid waste stream. The District of Columbia Office of Property Management (OPM) is the lead agency for government recycling and is coordinating with each agency to ensure recycling services are being effectively implemented.

While the District has made progress towards improving standards for water, air, and energy, city agencies have fallen short of addressing the previous plan's goals for more efficient environmental review procedures for citywide building projects and development. The Office of Planning and Department of Consumer and Regulatory Affairs have responsibility for environmental review of development projects, whether through the large tract review process, the D.C. Environmental Policy Act process, or the review of contaminated property site assessments. However, these review processes remain largely unfunded, and the procedural and regulatory framework for the Environmental Policy Act and contaminated site reviews largely undeveloped. The District has not adequately established a funding or administrative structure to ensure that these review procedures are a priority.

In summary, the Comprehensive Plan Revision process provides an opportunity to restate and revisit relevant policies from the existing plan, develop new policies and actions that address the current issues more effectively and holistically, and promote the use of policies, initiatives, and technologies that are reflective the current understanding of conservation, planning, and management of environmental resources in an urban setting.

2.0 ENVIRONMENTAL BASELINE

The following environmental baseline discussion provides a brief overview of the major natural resources in the District broken into five major categories: Air Resources, Land Resources, Water Resources, Biotic Resources, and Environmental Hazards. Information presented under each major category is broken down into four sections, *Regulatory Framework, Characterization, Planning Issues, and Major Trends.*

The first section of each resource area outlines the *Regulatory Framework* governing the management of that resource at both the Federal and local level. A brief discussion of the agencies responsible for implementing and monitoring compliance of the regulations is also provided.

The second section, *Characterization*, presents an inventory and general description of the dominant air, land (soils), water, and biotic resources, as well as the environmental hazards in the District. This step utilizes readily available data from government databases, existing management plans, and published reports to provide a broad scale review of the major characteristics of these five major resource areas.

The third section in each major resource category, *Planning Issues*, provides a brief, but more issue focused discussion of the major planning concerns pertinent to that environmental resource. This phase describes what noted problems and concerns are associated with major environmental resources in the District, and provides information at a scale suitable for analyzing broad scale effects of any newly proposed or revised environmental policies, programs, or initiatives.

Finally, each major resource section concludes with a brief summary of the major identifiable *Trends* in the environmental resource. Trends are presented in general terms as they would occur in the absence of the proposal of any policies or initiatives.

2.1 AIR RESOURCES

2.1.1 REGULATORY FRAMEWORK

Air resources in the District are regulated at the federal, regional, and local level. These regulations create the framework within which the District must operate for its planning efforts.

Federal Regulations

The EPA defines ambient air in 40 CFR Part 50 as "that portion of the atmosphere, external to buildings, to which the general public has access." At the federal level, air emissions in the District are regulated by the 1970 Clean Air Act (CAA) and the 1977 and 1990 Clean Air Act Amendments (CAAA). In compliance with the CAA and the CAAA, the EPA has promulgated ambient air quality standards and regulations, known as National Ambient Air Quality Standards (NAAQS). These standards were established for the protection of public health in order to allow allowed for an adequate margin of safety for six criteria pollutants. To date, the EPA has issued NAAQS for six criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), particles with a diameter less than or equal to a nominal 10 micrometers (PM10), ozone (O3), nitrogen dioxide (NO_2), and lead (Pb). The EPA promulgated a standard for fine particulates (PM2.5) in April 2005; however, PM2.5 *de minimis* thresholds are not yet finalized and federal actions with conformity determinations prior to April 2006 will be grandfathered from these requirements. Areas that do not meet NAAQS are called non-attainment areas, indicating that the pollutant has reached levels determined to have adverse effects on human health. When a state is in non-attainment for a pollutant, the state must create a State Implementation Plan (SIP) that regulates how the state plans to come into attainment.

Under the NAAQS, primary and secondary standards are designated for each pollutant. Primary standards are designed to protect sensitive populations within the public, such as children and the elderly, from adverse health effects due to exposure to the pollutant. Secondary standards are designed to protect the environment, both natural and manmade, from known adverse effects from a pollutant.

In 1997, the NAAQS were revised and more stringent standards were created for both ozone and particulate matter. Ozone had previously been held to a one hour standard of 0.12 parts per million (ppm). Under these revisions, the EPA supplanted the one hour standard with an 8 hour standard of 0.08 ppm. Additionally, the PM_{10} standards were left in place but 24 hour and annual standards were created for $PM_{2.5}$ at 65 and 15 micrograms per cubic meter, respectively. The new standards were challenged in the courts but as of February 2001, the Supreme Court upheld the EPA's authority to set the national ambient air quality standards. **Table 2.1** provides the NAAQS set forth by EPA. The DC standards for these pollutants are identical, except no secondary standard has been established for $PM_{2.5}$.

Table 2.1 Ambient Air Quality Standards

Pollutant	Primary	Secondary
Carbon Monoxide (CO)		
1-hour Average	35 ppm	--
8-hour Average	9 ppm	--
Sulfur Dioxide (SO_2)		
3-hour Average	--	1300 µg/m3
24-hour Average	365 µg/m3	--
Annual Arithmetic Mean	80 µg/m3	--
Particulates (PM10)		
24-hour	150 µg/m3	--
Annual Geometric Mean	50 µg/m3	50 µg/m3
Particulates (PM2.5)*		
24-hour	65 µg/m3	--
Annual Geometric Mean	15 µg/m3	15 µg/m3
Ozone (O3)		
1-hour Average	0.12 ppm	0.12 ppm
8-hour Average**	0.08 ppm	0.08 ppm
Nitrogen Dioxide (NO_2)		
Annual Arithmetic Mean	100 µg/m3	100 µg/m3
Lead (Pb)		
Quarterly Average	1.5 µg/m3	1.5 µg/m3

Notes:
ppm = parts per million
µg/m3 = micrograms per cubic meter
Annual Standards never to be exceeded; short-standards not to be exceeded more than once a year.
*: Standards attained when the highest 99th percentile of 24-hour concentration over 3 years is below 65 µg/m3
**: Standards attained when the 3-year average of 4th-highest maximum 8-hour concentration is below 0.08 ppm
Source: 40 CFR 50, July 1991, revised July 1997 and march 26, 2002 EPA Announcement, Ambient Air Quality Standards.

Metropolitan Washington Council of Governments

Recognizing that air quality is a regional resource, the Metropolitan Washington Council of Governments (MWCOG) has been established as the agency responsible for coordinating air quality planning initiatives. As part of this responsibility, elected officials of the MWCOG member jurisdictions make up the Metropolitan Washington Air Quality Committee (MWAQC). This committee is certified by the mayor of the District of Columbia and the governors of Maryland and Virginia to prepare an air quality plan for the DC-MD-VA Metropolitan Statistical Area under Section 174 of the CAAA. Other members of the committee include: the air management and transportation directors of the District of Columbia, Maryland, and Virginia; members of the Maryland and Virginia General Assemblies; and the chair of the Transportation Planning Board. A primary purpose of the committee is to coordinate air quality planning activities among MWCOG, other external committees, and the Transportation Planning Board; review policies; resolve policy differences; and adopts an air quality plan for transmittal to the District, Maryland, and Virginia. As part of a greater regional air basin, the District must work within this regional framework.

Interstate Air Quality Council (IAQC)

In 2005, the Mayor of the District of Columbia and the Governors of the State of Maryland and the Commonwealth of Virginia established the Interstate Air Quality Council (IAQC) in an effort to improve air quality in the Washington region. The council, comprised of six secretaries of the Environment and Transportation from Maryland, Virginia, and the District, will review and improve the regional air quality planning process to ensure that the jurisdictions effectively meet new federal standards for ozone and fine particulates. Maryland will chair the council (Ehrlich, 2005).

Ozone Transport Commission (OTC)

The Ozone Transport Commission (OTC) is a multi-state organization created under the Clean Air Act (CAA) responsible for advising the EPA on transport issues and for developing and implementing regional solutions to the ground-level ozone problem in the Northeast and Mid-Atlantic regions (OTC, 2004).

Department of Health

Within the District, the Department of Health's (DOH) Environmental Health Administration's Air Quality Division is responsible for monitoring source and criteria pollutants in order to maintain compliance with the CAA and issuing permits to facilities within the District. Daily monitoring results are submitted to the EPA on a monthly basis, and daily measurements taken each morning and afternoon are provided to MWCOG to determine the area's daily Air Quality Index (AQI), or level of air quality. The MWCOG index creates a uniform regional system of ambient air quality measure.

In addition to daily air quality monitoring, DOH also has permitting responsibilities for air quality pollutant sources. For stationary source pollutants, each source must submit a written report stating all names and amounts of chemicals used. For sources that emit over 25 tons a year of a criteria air pollutant, records must be submitted annually stating pertinent operating

information, emissions, methods for obtaining emissions, a statement of accuracy, and the control equipment currently in use.

2.1.2 CHARACTERIZATION

The District of Columbia is currently in non-attainment for ozone and $PM_{2.5}$. For ozone, the District is classified as severe non-attainment for the one-hour standard and moderate for the 8-hour standard. The District is also classified as a carbon monoxide (CO) maintenance area after having moved from non-attainment to attainment but is still operating under a maintenance plan. The District is in attainment for NO_2, SO_2, lead, and PM_{10}. **Table 2.2** and **Table 2.3** show the four highest records of exceedence of the NAAQS for ozone and $PM_{2.5}$.

Table 2.2 Ozone Monitor Values 2005

	Monitor Location	1st max value	2nd max value	3rd max value	4th max value	Days Above Std.
1 hour values	Takoma Sch. Piney Branch Rd & Dahlia St	0.105 ppm	0.101 ppm	0.097 ppm	0.094 ppm	0
	34th & Dix St, N.E.	0.105 ppm	0.099 ppm	0.099 ppm	0.098 ppm	0
	S.E. End Mcmillian Reservoir	0.109 ppm	0.108 ppm	0.103 ppm	0.101 ppm	0
8 hour values	Takoma Sch. Piney Branch Rd & Dahlia St	0.087 ppm	0.084 ppm	0.082 ppm	0.077 ppm	1
	34th & Dix St, N.E.	0.089 ppm	0.082 ppm	0.082 ppm	0.081 ppm	1
	S.E. Mcmillian Reservoir	0.093 ppm	0.088 ppm	0.087 ppm	0.086 ppm	5

Source: EPA, 2005

Table 2.3 PM 2.5 Monitor Values 2005

	Monitor Location	1st max value	2nd Max value	3rd Max Value	4th Max Value	98th percentile	Mean	Exceeded standard?
24 hour values	34th & Dix St, N.E.	29 µg/m3	26 µg/m3	24 µg/m3	23 µg/m3	29 µg/m3	--	No
	34th & Dix St, N.E.	35 µg/m3	35 µg/m3	34 µg/m3	33 µg/m3	34 µg/m3	--	No
	Park Services Office 1100 Ohio Dr	36 µg/m3	33 µg/m3	33 µg/m3	29 µg/m3	33 µg/m3	--	No
	S.E. End McMillan Reservoir	36 µg/m3	35 µg/m3	34 µg/m3	33 µg/m3	33 µg/m3	--	No
Annual Values	34th & Dix St, N.E.	--	--	--	--	--	12.4	No
	34th & Dix St, N.E.	--	--	--	--	--	16.8	Yes
	Park Services Office 1100 Ohio Dr	--	--	--	--	--	16.5	Yes
	S.E. End McMillan Reservoir	--	--	--	--	--	16.1	Yes

Source: U.S. EPA, 2005.

Permitted Emission Sources

Air quality is a regional resource that is affected by both local and global influences. Although not all sources of air pollution can be easily regulated or controlled, the District is able to regulate mobile and non-mobile sources at the local level in an attempt to influence air quality.

The NAAQS breaks down air pollution sources into two categories: stationary and mobile. Within the stationary sources, pollution sources are again categorized as either a small or large stationary source. As of October 2005, a total of 564 stationary sources were permitted or regulated by the CAA within the District (EPA, 2005). Of these sources, 554 were designated as small stationary, such as dry cleaners or gas stations, and remaining ten as large stationary sources. These 10 sources emit above the reporting threshold and therefore have to monitor and report their emissions annually to the EPA. Sources of emissions are shown in **Figure 2.1**.

The 10 sources are the U.S. Soldiers and Airmen's Home, the U.S. Government Printing Office, and U.S. Bureau of Engraving and Printing, St. Elizabeth's Hospital, PEPCO Buzzard Point Generating Station, PEPCO Benning Road Generating Station, Howard University, GSA West Heating Plant, GSA Central Heating Plant, Georgetown University Power Plant, and the Capitol Power Plant. The EPA has data from 1999 detailing the amount of pollution generated by the large stationary sources, as shown in **Table 2.4**.

Table 2.4: Large Facility Emissions Data – 1999					
Facility Name	**Facility ID**	**NOx Emissions**	**VOC Emissions**	**PM 2.5 Emissions**	**Total Emissions**
U.S. Soldiers and Airmen's Home 3700 N. Capitol ST. NW	11001-0011	NA	NA	NA	0.032
U.S. Government Printing Office* 45 G St. NW	11001-7347879	NR	145,442	NR	NR
U.S. Bureau of Engraving and Printing* 14th St. & C St. SW	11001-00134	NR	251,760	NR	NR
St. Elizabeth's Hospital 2700 Martin Luther King Dr. SE	11001-0009	42	0.54	3.16	277
PEPCO Buzzard Point Generating Station 1st & V St. SW	11001-0040	101	7.08	9.47	302
PEPCO Benning Road Generating Station 3300 Benning Rd. NE	11001-0001	447	13	28	1,197
Howard University 2240 6th St. NW	11001-0022	NA	NA	NA	1.55
GSA West Heating Plant 1051 29th St. NW	11001-0024	NA	NA	NA	0.39
GSA Central Heating Plant 13th & C St. SW	11001-0025	247	1.6	42	345
Georgetown University Power Plant* 37th & O St. NW	11001-00059	NR	2381	NR	NR
Capitol Power Plant New Jersey Ave & E St. SE	11001-0006	329	1.74	131	1,247

Sources: EPA, 2005, *AIRS/AFS Database, 1996
Notes: NA = Not applicable, emission not produced
Totals include all emissions (NOx, VOC, CO, SO_2, PM_{10}, $PM_{2.5}$, NH_3)
NR- Not reported

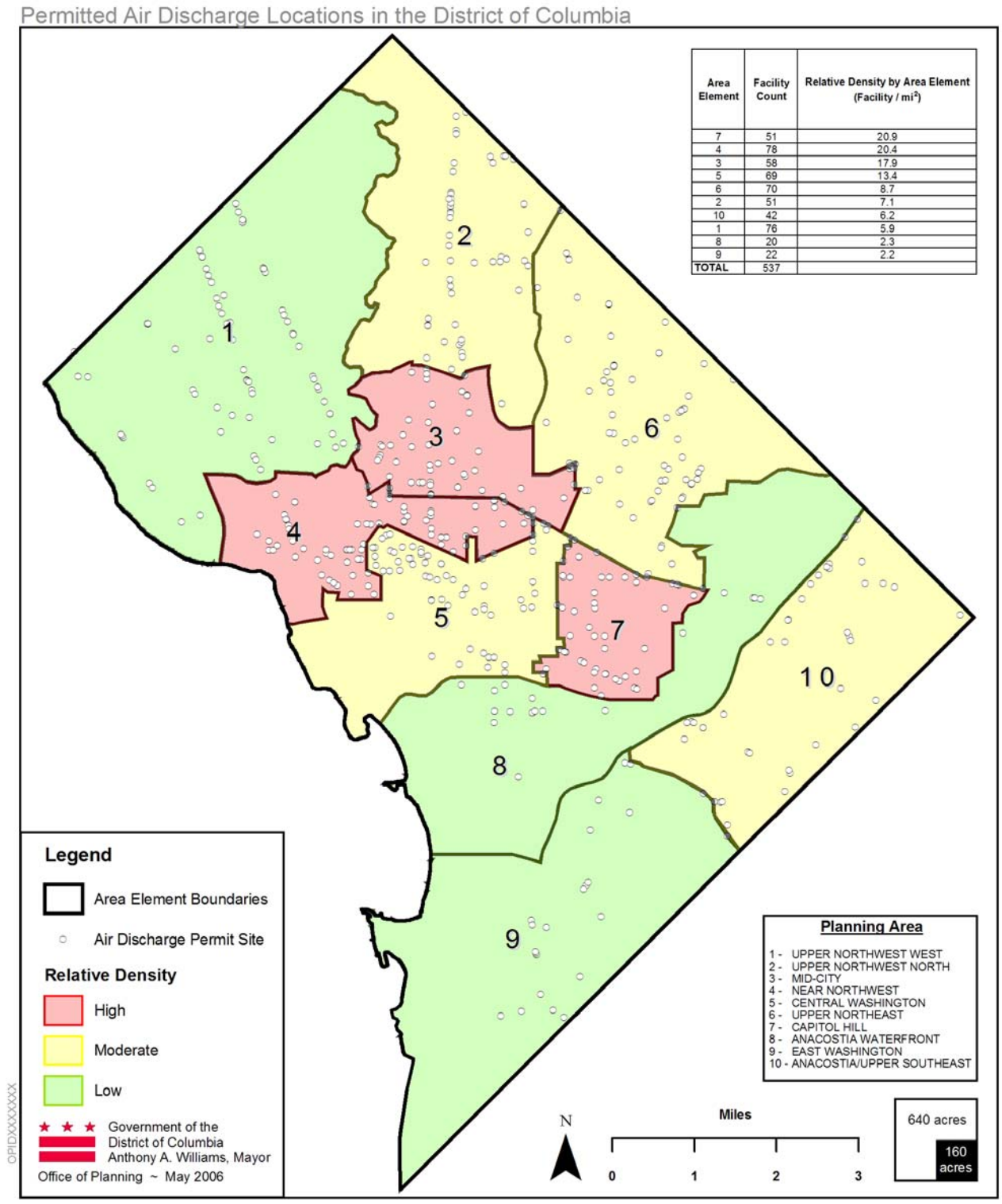


Figure 2-1: Permitted Air Discharge Locations in the District of Columbia

According to the EPA AIR Data database, as of 2003, all of the large stationary sources were in compliance with all regulations with the exception of Howard University and the GSA Central Heating Plant. The two U.S. printing sources only emit VOCs and no other criteria pollutants above the reporting threshold. They account for almost all VOC emissions in the district, however, emitting 397,202 pounds per year (lbs/yr) out of the districts total of 433,605 lbs/yr, or nearly 92 percent. The major sources of PM (monitored as total suspended particles, TSP) are the Benning Road PEPCO plant, St. Elizabeth's Hospital, and the U.S. Soldiers and Airmen's Home. The Benning Road PEPCO Plant and St. Elizabeth's Hospital were also major sources of SO_2 in addition to the majority of the fossil fuel plants within the district. Capitol Power Plant is the only large stationary source that emits a large amount of CO, at 159,215 lbs/yr. The Benning Road power plant is second for CO emissions at only 90,390 lbs/yr. (Versar, Inc., 1997).

Mobile Sources

The EPA's 2005 Greenhouse Gas Emissions Inventory states transportation activities accounted for 32 percent of CO_2 emissions from fossil fuel combustion in 2003. Over 60 percent of the emissions resulted from gasoline consumption for personal vehicle use. The remaining emissions came from other transportation activities including the combustion of diesel fuel in large heavy-duty vehicles and jet fuel.

The primary criteria pollutants associated with mobile sources, such as vehicles, are CO and the ozone precursors, VOCs and NOx. Mobile source combustion was the second largest source of NO_2 emissions in the US between 1990 and 2003. During that period, numerous control technologies were being newly implemented to reduce the CO, NOx, NMVOC, and CH_4 emissions. While the goal was a net reduction of harmful emissions, the additional industrial processes required to mitigate the emissions actually generated a 26 percent increase in N_2O emissions 1990 and 1998 (EPA, 2005). However, since 1998 new control technologies have resulted in a steady decline in NO_2 from mobile sources.

Table 2.5: Mobile Source Emissions

Mobile Fossil Fuel Combustion	**1991**	**1998**	**2000**	**2003**
NOx Emissions	12,134	11,592	10,823	10,418
CO	119,482	87,940	83,680	75,526
NMVOCs	10,933	7,742	7,230	6,351
SO_2	793	665	632	634
Sources: EPA, Greenhouse Gas Emissions Inventory- 2005				

In the DC area it has been estimated that approximately one quarter of all person trips involve travel to and from work. According to the 2000 Census, nearly 2.4 million workers live in the Washington region, up from 2.2 million in 1990. The majority of DC area drivers commute to work alone, a number that rose from 60% in 1990 to 67% in 2000 (COG, 2004). This upward

trend in population and work force is expected to continue in the District and surrounding areas, making mobile sources a concern for future air management planning.

In addition to daily commuters, the District and the surrounding area contains many highways that are used for the transportation of goods. Trucks represent between 3 percent and 8 percent of the traffic on most of the major routes in the Washington area. On the southern portion of I-495/I-95, however, between 12 and 15 percent of the traffic is comprised of trucks (COG, 2004). Diesel trucks emit a large amount of PM2.5.

The EPA categorized the District's total emissions by source category with 1999 data and for CO. This study showed that mobile sources account for nearly 94 percent of the Districts total emissions. Vehicles were found to account for 77 percent of all NOx emissions and 46 percent of all VOC emissions. CO emissions tend to affect health and environment on a local scale while ozone, as already stated, impacts surroundings on a regional level (EPA, 2005).

2.1.3 PLANNING ISSUES

Ozone

There are two types of ozone, stratospheric (upper-level) and tropospheric (lower level). Upper level ozone protects the earth by preventing harmful UV rays from entering the atmosphere and does not constitute a risk to human health. In terms of the CAA and the NAAQS, the ozone discussed is lower level ozone, which is harmful to human health. Lower level ozone is formed when volatile organic compounds (VOCs) and NO_2 combine and react with heat in the troposphere. VOCs and NO_2 are created by stationary sources, such as a power plant. These stationary sources are issued permits for NO_2 and VOCs to regulate emission levels. **Figure 2.2** shows the number of days above the 8-hour ozone standard at three monitoring stations in the District from 1995 to 2005.

Table 2.6: 2003 Emissions of NOx, CO, NMVOCs, and SO_2

Activity	NOx	CO	NMVOCs	SO_2
Stationary Fossil Fuel Combustion	7,222	4,454	1,007	12,477
Mobile Fossil Fuel Combustion	10,418	75,526	6,351	634
Industrial Processes	648	2,431	1,711	1,029
Solvent Use	4	65	4,138	2
Waste	2	8	125	1
Sources: EPA, Greenhouse Gas Emissions Inventory- 2005				

The main contributors to NO_2 and VOC emissions in the District are vehicles and industrial utilities. For 2005, the American Lung Association rated the District as an F with 36 days above the 8 hour standard for the summer months, when ozone is at its worst (ALA, 2005). Overall, in

1999 the District emitted fewer ozone precursors than other cities in the northeast region, such as New York and Philadelphia, but more days above the 8 hour standard.

In addition to stationary sources that can be controlled and regulated at the local level, ozone is also transported into the District from other areas of the county by a change in air flows during the summer months. Wind action known as a Bermuda high air flow begins south of the District and creates a large clockwise air formation that flows up towards Ohio. Once reaching the Ohio area, the clockwise motion continues and air pollution created from Ohio River Valley power plants is carried into the DC region. Air pollution sources that come from outside the DC region, but contribute to the air quality are studied by the University of Maryland. The University monitors ozone transport into the area and has measured as much as 0.11 ppm of ozone floating in from the west at any one time. That level is nearly the entire 1 hour standard of 0.12 ppm and above the 8 hour standard of 0.08 ppm (MDE, 2004).

At the local level, emissions of NO_2 and VOC in the District are regulated by a regional SIP in order to come into attainment for both ozone standards. The revised *Plan to Improve Air Quality in the Washington, DC-MD-VA Region, State Implementation Plan) ("Severe Area SIP") for Washington, DC-MD-VA Ozone Nonattainment Area* focuses on improving air quality in the Washington region to meet the national air quality standard for ozone (one-hour ozone standard). The Severe Area Attainment Plan shows the progress being made on improving air quality in the Washington nonattainment area and the efforts underway to assure that the region takes all necessary steps to reach the federal health standard for ground-level ozone by 2005.

These local and regional level concerns would be included in future air management planning in the District. The District can initiate transportation management and planning, facilities management, waste management actions, and other programs to reduce greenhouse gas emissions. The District has the opportunity to integrate new planning development standards with improved air quality through measures such as encouraging the adaptive reuse of Brownfields, installing reflective exterior building materials, promoting new renewable energy systems in new buildings, and encouraging more extensive urban forestry, recycling, and alternative modes of transit.

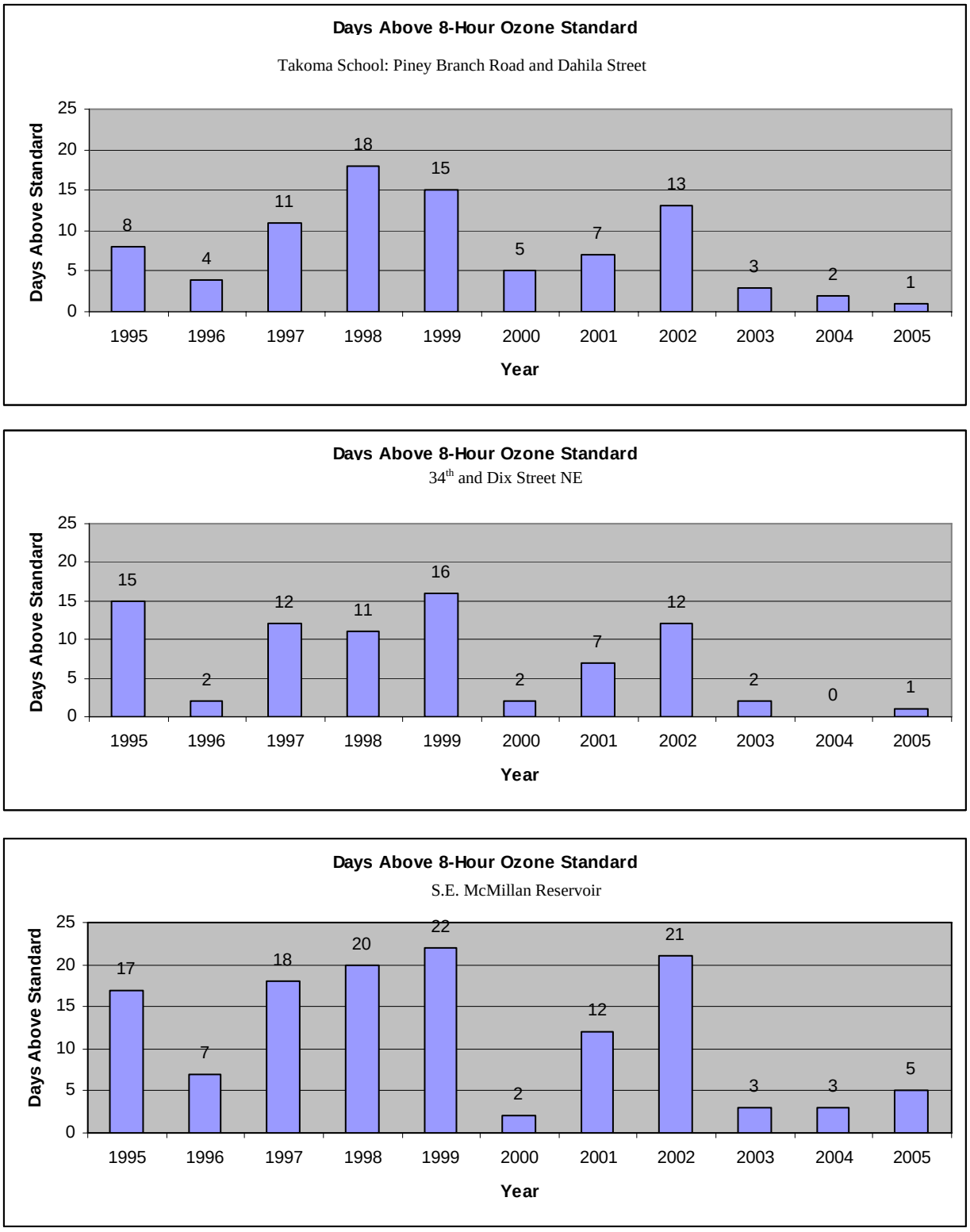


Figure 2.2 Number of Days Above 8 Hour Ozone Standard at 3 DC Air Quality Sampling Stations

Particulate Matter

Particulate matter is any solid or liquid that exists in a finely divided form. Health effects associated with particular matter emissions include aggravation of respiratory and cardiovascular disease, lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems. The NAAQS regulate the larger PM_{10} and the newly added $PM_{2.5}$. $PM_{2.5}$ NAAQS were created in 1997 and includes dust and soot. The main sources of PM are diesel combustion, dust particles, and construction. As of 2002, the District is in non-attainment for $PM_{2.5}$.

While there have been NAAQS standard for $PM_{2.5}$ since 1997, recent events have changed how these standards are applied and interpreted, which should be taken into consideration for air management planning in the District. When first promulgated, these new standards were challenged by many state and business groups. The Supreme Court upheld EPA's authority in 2001 under the CAA to set NAAQS that protect the public from harmful effects of air pollution and in March 2002, the DC Circuit Court rejected all remaining legal challenges to EPA's 1997 ambient air quality standards for PM-2.5. Designations for non-attainment for this pollutant, such as found in the District, became effective in April 2005.

On September 8, 2005, EPA proposed requirements that state and local governments have to meet as they implement the new standard. EPA established the PM2.5 standards in 1997 and designated areas as attainment or nonattainment in December 2004. This proposed rule is the next step toward improving particle pollution air quality for millions of Americans. States must meet the PM 2.5 standard by 2010. However, in their 2008 implementation plans, states may propose an attainment date extension for up to five years. Those areas for which EPA approves an extension must achieve clean air as soon as possible, but no later than 2015. The District will need to incorporate these new standards in future air quality planning.

Health Impacts

Potentially negative health effects associated with poor air quality are decreased lung function, respiratory disease, and cancer. A strong correlation has been found between air quality and asthma rates. The groups at-risk for asthma are children, the elderly, and those who have a pre-existing respiratory condition. According to the American Lung Association (ALA), out of a population of 564,353 in the District, there were 9,225 cases of pediatric asthma and 35,784 cases of adult asthma in 2005. In 2003, there were 6,359 cases of pediatric asthma and 33,828 cases of adult asthma with a total population of 572,059. While the population decreased during 2004 and 2005, both categories of asthma grew with pediatric asthma increasing by over 33 percent. The ALA also produces an annual report of the high ozone days in the District. The days are designated as Yellow, Red, Orange, or Purple. Yellow days are when ozone is at a level that may be unhealthy for unusually sensitive groups at 0.085-0.104 ppm Orange days are when ozone is at an unhealthy level for sensitive groups at 0.085-0.104 ppm. Code red days are when ozone is unhealthy for the general public at a level of 0.105-0.124 ppm, and code purple days are very unhealthy with levels of 0.125-0.374 ppm of ozone. According the ALA, in 2003, the District had 35 orange days and 4 red days. In 2005, the District recorded only 25 orange days,

but 10 red days and 1 purple day[8]. While the total number of high ozone days has decreased since 2003, the intensity of the levels of ozone and the rate of pediatric asthma have increased.

Indoor Air Quality

In addition to ambient air quality, indoor air pollution is an important aspect of air quality management in the District. The NAAQS do not account for indoor air pollutants and, on the whole, they are unregulated. The sources of indoor air pollutants are materials found within the home, off-gassing from objects like carpets or pressed wood and cleaning products, radon, mold, carbon monoxide from boilers and furnaces, fibers and irritants, and smoke from cigarettes and other tobacco products. In addition to these sources, poor ventilation adds to the problem of indoor air pollution by not allowing air to circulate or by dispersing contaminants throughout the building. The health effects of poor indoor air quality can range from short-term, easily treatable effects such as dizziness, nausea, and rashes, to long-term, serious effects such as lung cancer, and heart or respiratory disease, including asthma.

Two of the most common indoor air pollutants that are present in the District are radon and mold. Radon is a naturally occurring, toxic, colorless gas that is a result of the breakdown of the radioactive radium. Radon is found naturally in soil and rock beneath homes, in well water, and is also present in building materials. While there are no immediate symptoms felt from radon exposure, it is a known carcinogen and causes an estimated 21,000 deaths from lung cancer annually in the United States (EPA,2005). Out of these deaths, an estimated 2,900 are non-smokers. Radon is the only regulated indoor air pollutant with an indoor action level of 4 picocuries per liter (pCi/L) set by the EPA. The average level of radon in buildings is 1.3 pCi/L while the average outdoor level of radon is 0.4 pCi/L. (EPA,2005)

The DOH-EHA's Radon Program has educated and informed the public on radon issues over the past ten years. Outreach activities include interacting with District residents across the city to provide radon information, literature, and test kits for those who desire to test their homes. Community events such as the Latino Festival, the Black Family Reunion, the Black Caucus, the Greater Southeast Hospital Health Fair, the Ward 8 Community Health Fair, the NBC4 Your Health and Fitness Expo, and Adams Morgan Day all provide opportunities to disseminate radon information. Free radon tests kits are offered by EHA so that District residents can test radon levels in their homes. When results from these test kits are available, the EHA enters them into a database that includes the name of the event where the test kit was disbursed, the name of the recipient, address, type of home (single family residence detached, semi-detached, row house or apartment), telephone number, test kit number, and test kit results.

Mold, a common indoor air pollutant, is produced when spores that are carried in the air land in a damp area and grow and spread. Excessive moisture results in the spread of mold in homes, especially when moisture levels are allowed to remain high for a long period of time. It is very difficult to eliminate mold from an indoor environment but it can be limited through moisture

[8] MWCOG's Air Quality Index for 2005 shows 45 yellow days (0.-66-0.085 ppm) and 19 orange days (0.086-0.100 ppm)

control. Inhalation of molds can cause adverse health effects in sensitive populations, including the young and elderly, such as nasal stuffiness, eye or skin irritation, or wheezing. Additionally, people severely allergic to mold may have severe reactions. Severe reactions, such as fever or shortness of breath, may also occur in the workplace in a case such as an office worker working in a building where the roof, windows, or pipes are in poor repair and leaking. For people with pre-existing chronic lung illness, mold infections in the lungs are a possible health effect from mold exposure. EHA provides public information on mold issues, such as informing homeowners of actions to take after their home has been flooded to avoid mold formation. EHA also provides technical support to the Department of Consumer and Regulatory Affairs, which is responsible for enforcing housing and building codes.

In January 2006, the DC Council passed the Smoke Free Bill (16-293). This legislation applies immediately to all restaurant seating areas and would be extended to bars, nightclubs, taverns and the bar areas of restaurants in January 2007.

Pollution reductions for mobile sources in the District

The EPA is finalizing the criteria for determining which transportation projects must undergo a local air quality analysis (i.e., a "hot-spot analysis") as part of conformity determinations in areas not meeting PM2.5 (particulate matter smaller than 2.5 micrometers in diameter) air quality standards. A "hot-spot analysis" is an estimation of pollutant concentrations in a localized area resulting from the use or operation of a transportation project, and a comparison of those concentrations to the National Ambient Air Quality Standards (NAAQS). While the new PM2.5 rule has not yet been adopted, the final rule will be issued by Sept 27, 2006. The District will conform to these new regulations. The proposed changes are to lower the 24 hour standard for PM 2.5 from 65 ug/m3 to 35 ug/m3. This final rule also streamlines existing hot-spot requirements in PM10 areas lowering the PM10 24 hour standard from 150 ug/m3 to 70 ug/m3.

2.1.4 TRENDS

MWCOG's Air Quality Trend Analysis from 1993 to 2003 details the trends per air pollutant for the District. The study includes parts of Virginia and Maryland as well as DC, and provides the overall trend for this regional resource. This report found that, in general, regional air quality is improving. The Washington metropolitan area meets the minimum federal health standards for four of the six criteria pollutants.

Ozone

Overall, ozone is decreasing, with a total of three days above the one hour standard in 2003, as opposed to 8 days above the standard in 1993. Days above the standard are calculated when any monitor within the region has a reading above the 0.120 ppm level. The days above the 8 hour standard show a slight downward trend however there is no clear trend for a continued decrease. Between 1997 through 1999, the numbers for days exceeding the 8 hour standard experienced a large peak. Factors such as unusually warm weather may have contributed to this spike.

These trends indicate that ozone levels will continue deceasing, more for the one hour standard than the 8 hour standard; however, these trends are difficult to predict because of outside influences such as metrological conditions. Temperatures above 85 degrees Fahrenheit, light

winds, and stationary high pressure systems contribute to the formation of ozone and are a factor that will influence future ozone levels (MWCOG, 2004).

Carbon Monoxide

Carbon Monoxide levels in the region have been declining since 1990. The District used to be in non-attainment for this pollutant, but now all of the monitors in the area register at levels below the standard. Carbon Monoxide levels are below the health standards for all monitors in the region and are expected to stay below regulatory levels.

Sulfur Dioxide

Sulfur Dioxide levels are low within the DC metro area and continue to decline. During the entire analysis period, the levels of SO_2 never exceeded the NAAQS standard, and in most recent years was as low as ¼ of the standard. It is expected that SO_2 levels will remain low in future years and stay below regulatory levels.

Nitrogen Dioxide

MWCOG found that NO_2 held no trend throughout the study period from 1993 to 2003. The levels showed no trend to be increasing or decreasing, yet the highest values at the monitors were still all well below the standards. MWCOG believes that NO_2 will continue to remain in attainment for the region and stay below regulatory levels.

Particulate Matter

Annual levels for PM_{10} have been in attainment for the entire length of the study. While under the attainment level, PM_{10} levels have shown a decreasing trend in the past 11 years.

Monitoring for $PM_{2.5}$ began in 1999 and the median monitor values are above the annual standard. Overall, however, the highest monitor values have shown a decreasing trend since 1999. The region is in attainment for the 24-hour $PM_{2.5}$ standard, but still in non-attainment.

Lead

All monitors in the area are well below the regulatory levels for lead, a fact that has been a result of lead being removed from gasoline. Lead levels should remain well within the standard in the future and below the regulatory level.

Asthma

Trends for asthma are expected to increase as long as the levels of ozone continue to increase. The Ozone Transport Commission is working on decreasing ozone precursors in the northeast region, and therefore decreasing the levels in the District. The District's SIP states how the area will reduce VOCs and NOx in order to decrease levels of ozone, which should impact this trend.

2.2 LAND RESOURCES

2.2.1 REGULATORY FRAMEWORK

The Watershed Protection Division (WPD) of the Environmental Health Administration is responsible for the conservation of soil and water resources. Activities relating to the investigation and remediation of contaminated soils and groundwater are presently located within the Bureau of Hazardous Material and Toxic Substances, and are discussed under the section of this report on environmental hazards. WPD is divided into three branches, the Sediment and Storm Water Technical Services Branch, Inspection and Enforcement Branch, and the Non-point Source Pollution Management Branch, each with a role in developing and enacting stormwater management and sediment and erosion control regulations for construction sties. The regulations governing storm water management, erosion and sediment control, and floodplain management are outlined in Chapter 5 of Title 21 and Chapter 31 of Title 20 of the District of Columbia Municipal Regulations.

The Soil Erosion and Sedimentation Control Act (1977 as amended) calls for a program to review and approve all construction and grading plans submitted to the District of Columbia Government for compliance with regulations. In addition, DC Public Law 8-36 (the District of Columbia Environmental Policy Act of 1989) requires that all District of Columbia agencies consider the environmental impact of all proposed major actions prior to issuing any approvals of such actions. Inspections are conducted at construction sites to ensure that control devices are constructed in accordance with approved plans. The program is also responsible for investigating erosion, drainage, related complaints, and providing recommendations towards their resolution.

The Sediment and Storm Water Technical Services Branch is responsible for managing land disturbing activities to prevent the acceleration of soil erosion and sediment deposition in the Potomac and Anacostia Rivers and their tributaries. In the District of Columbia, all land disturbing activities, unless specifically exempted from the soil erosion and sedimentation control regulations, require a building permit. The branch reviews construction and grading plans; coordinates the permit review process with the Department of Consumer and Regulatory Affairs; reviews environmental impact screening forms and environmental impact studies; reviews geotechnical reports, develops and upgrades storm water management, erosion and sediment control, and floodplain management regulations and guidance manuals; and provides technical assistance to planning issues related to its mission.

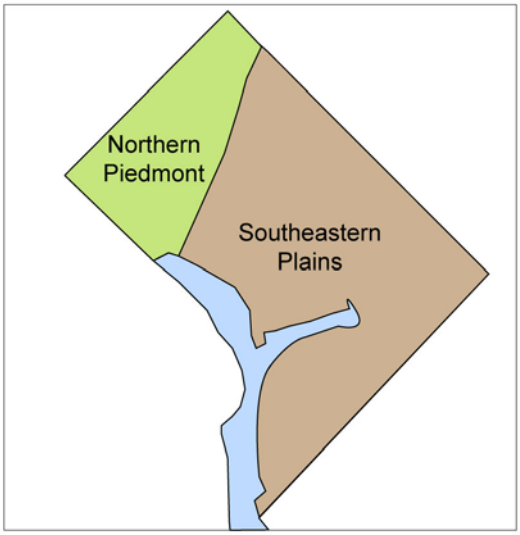
The Inspection and Enforcement Branch is responsible for developing and implementing inspection and enforcement programs in support of the regulation of land-disturbing activities. The branch is authorized to: inspect soil erosion and sediment control and storm water management facilities at construction sites for compliance; review and approve “As-Built” plans for storm water management facilities submitted to the District for compliance with design standards and specifications; investigate cases of soil erosion, water drainage, and related complaints; and conduct preventive maintenance inspections of storm water management facilities to ensure proper function.

The Nonpoint Source Pollution Management Branch's chief mission is to provide support to control, prevent, and remediate nonpoint sources of polluted runoff through voluntary activities. The DC Soil and Water Conservation District, a separate agency, is lodged within and receives support from this branch. The DC Soil and Water Conservation District identifies and coordinates available technical, financial, and educational resources to sponsor demonstration projects and activities that conserve the soil and water resources of the District. The Habitat Restoration Program participates and sponsors activities that protect and restore river, stream, and wetland habitats in the District of Columbia and the Chesapeake Bay watershed as a way to increase ecological diversity. The Education and Community Outreach Program encourages pollution prevention by providing effective public information and involvement in clean up efforts in the Anacostia River, Chesapeake Bay, and neighborhood watersheds. Some of the activities of this program include schoolyard conservation projects, environmental education camping, and the environmental education resource center.

2.2.2 CHARACTERIZATION & INVENTORY

Geology

The District of Columbia lies between two physiographic provinces – the Coastal Plain and the Piedmont. These two regions are separated by the Fall Line, a zone of geologic transition that marks the boundary between the older, resistant, metamorphic rocks of the Piedmont and younger, softer, mostly unconsolidated sediments of the Coastal Plain. Approximately two-thirds of the District is covered by the Coastal Plain Province (see adjacent graphic).



Level III Ecoregion Boundaries

The Coastal Plain Province is comprised of a wedge of sediments which increase in thickness toward the Atlantic Ocean. The lower two-thirds of the wedge, which rests on Precambrian to Mesozoic rocks, consists of clay, sand, and gravel sediments of the late Jurassic and Cretaceous age. These sediments were deposited by rivers flowing eastward from the Appalachian Mountains. The upper section of the wedge consists of Tertiary and Quaternary sand, silt, and clay sediments which are predominantly of marine origin.

The Piedmont Province is an area characterized by metasedimentary rocks of the Wissahickon Formation, altered mafic rocks, the Kensington Gneiss and Sykesville Formation, and later-aged granitic intrusives. The province is exposed along the Potomac River and Rock Creek and slopes in a southeasterly direction towards the Chesapeake Bay. It has a gently rolling topography, deeply weathered bedrock, and a relative paucity of rock outcrop. The outcrops are usually restricted to stream valleys where saprolite or weathered materials have been washed away by erosion.

Soil Characteristics

In 1974, the United States Natural Resources Conservation Service conducted a soil survey of the District. Since that time, no new regional soil survey has been conducted. Much of the information to be presented in this section will come from the 1974 soil survey.

The majority of soil map units in the District (approximately 70%) are characterized as being either partly or completely comprised of Udorthents, or soils that have been reworked or previously cut or filled, i.e. urban soils. These soil types are found throughout the District wherever development has occurred, and due to the disturbed nature of the soils, permeability is often variable in these areas, runoff is generally medium to rapid, and erosion can be severe where the surface is left bare. The disturbed nature of soils in these areas makes onsite characterization necessary to determine uses and limitations.

The next most common soil map units account for less than 17% of the District, and are all complexes with urban soils. The Christiana soil series consists of very deep, well drained soils with slow to moderately slow permeability on uplands and sideslopes of the dissected Coastal Plain. They formed in red clays of marine origin, have a low to moderate shrink swell potential, and are found on slopes ranging from 0 to 50 percent. These soils are predominately found in the Upper Northeast. The Manor soil series is also common in the District, and consists of very deep, well drained to somewhat excessively drained, moderately permeable soils on uplands. These soils are formed in materials weathered from micaceous schist, are typically found on slopes ranging from 0 to 65 percent, and can be highly erodible on the higher end of this slope range. The manor series dominates the Upper Northwest , and is common along the northern portion of Rock Creek. The last of the common soil series in the District is the Sassafras series. The Sassafras series consists of very deep, well drained soils with moderately or moderately slow permeability found on summits and sideslopes. They are derived from sandy marine and old alluvial sediments, have a slow to medium runoff potential, and have a low shrink swell potential (NRCS, 2006). These soils dominate Upper Northwest east of Rock Creek Park and are found in other parts of the Northwest and Northeast quadrants.

Hydrologic Groups

The NRCS defines a hydrologic group as a group of soils that have similar runoff potential under similar storm and cover conditions. The properties that influence runoff potential are the same ones that influence the minimum rate of infiltration for a bare, non-frozen soil after prolonged wetting. Hydrologic soil groups describe the different levels of infiltration capacity for any given soil type. There are four hydrologic groups (A, B, C, D) and three dual classes (A/D, B/D, C/D). As shown in **Table 2.7.** Hydrologic soil group “A” designates soils that are well to excessively well drained, whereas hydrologic soil group “D” designates soils that are poorly drained. This means that soils in hydrologic group “A” allow a larger portion of the rainfall to infiltrate and become part of the ground water system. Conversely, soils in hydrologic group “D” allow a smaller portion of the rainfall to infiltrate and become part of the ground water resulting in more rainfall conversion to surface water runoff on soils of this hydrologic group. The District is dominated by soils from Hydrologic Soil Group B and D.

Table 2.7: Hydrologic Soil Groups in the District of Columbia			
Hydrologic Soil Group	**Description**	**Acres**	**Proportion of District of Columbia**
A	High infiltration rates. Soils are deep, well drained to excessively drained sand and gravels.	3,308	7%
B	Moderate infiltration rates. Deep and moderately deep, moderately well and well-drained soils with moderately coarse textures.	17,161	39%
C	Moderate to slow infiltration rates. Soils with layers impeding downward movement of water or soils with moderately fine or fine textures.	7,764	18%
D	Very slow infiltration rates. Soils are clayey, have high water table, or shallow to an impervious cover	10,344	23%
B/D	Combination of Soil Group B and D	21	<1%
C/D	Combination of Soil Group C and D	907	2%
---	Not applicable	4,654	11%

Comparison between areas within District with respect to soil hydrologic groups shows that the majority of the low permeability/high runoff soils (C/D hydrologic groups) are found within in the heavily modified urban areas and corridors (**Figure 2.3**). The L'Enfant City is largely comprised of soils with these characteristics. In contrast, areas north and west of Rock Creek Park are dominated by soils with generally higher infiltration rates. In these areas, runoff potential would be generally low in the absence of development and associated impervious cover.

2.2.3 PLANNING ISSUES

Susceptibility to Erosion

The soil survey for the district classified each soil into one of three major erodibility categories (NRCS, 1974). These categories were developed based on an erodibility index derived from the Universal Soil Loss Equation (USLE) and the soil's T Factor, which represents the maximum annual rate of soil erosion that could take place without causing a decline in long-term productivity. The following table (**Table 2.8**) reports the number of acres found in each erodibility class in the District. The distribution of these erodibility classes is presented in **Figure 2.4**.

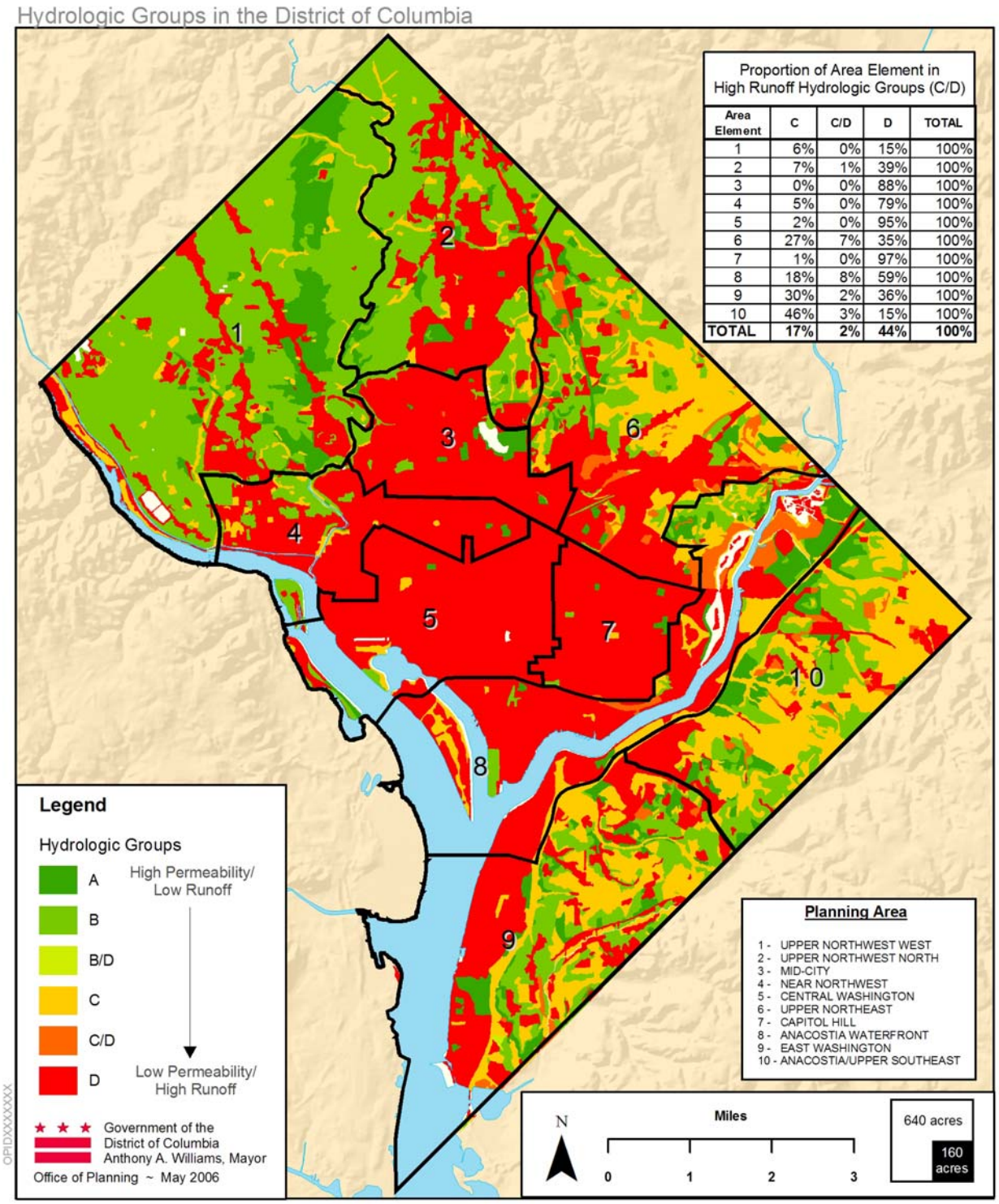


Figure 2.3: Hydrologic Groups in the District of Columbia

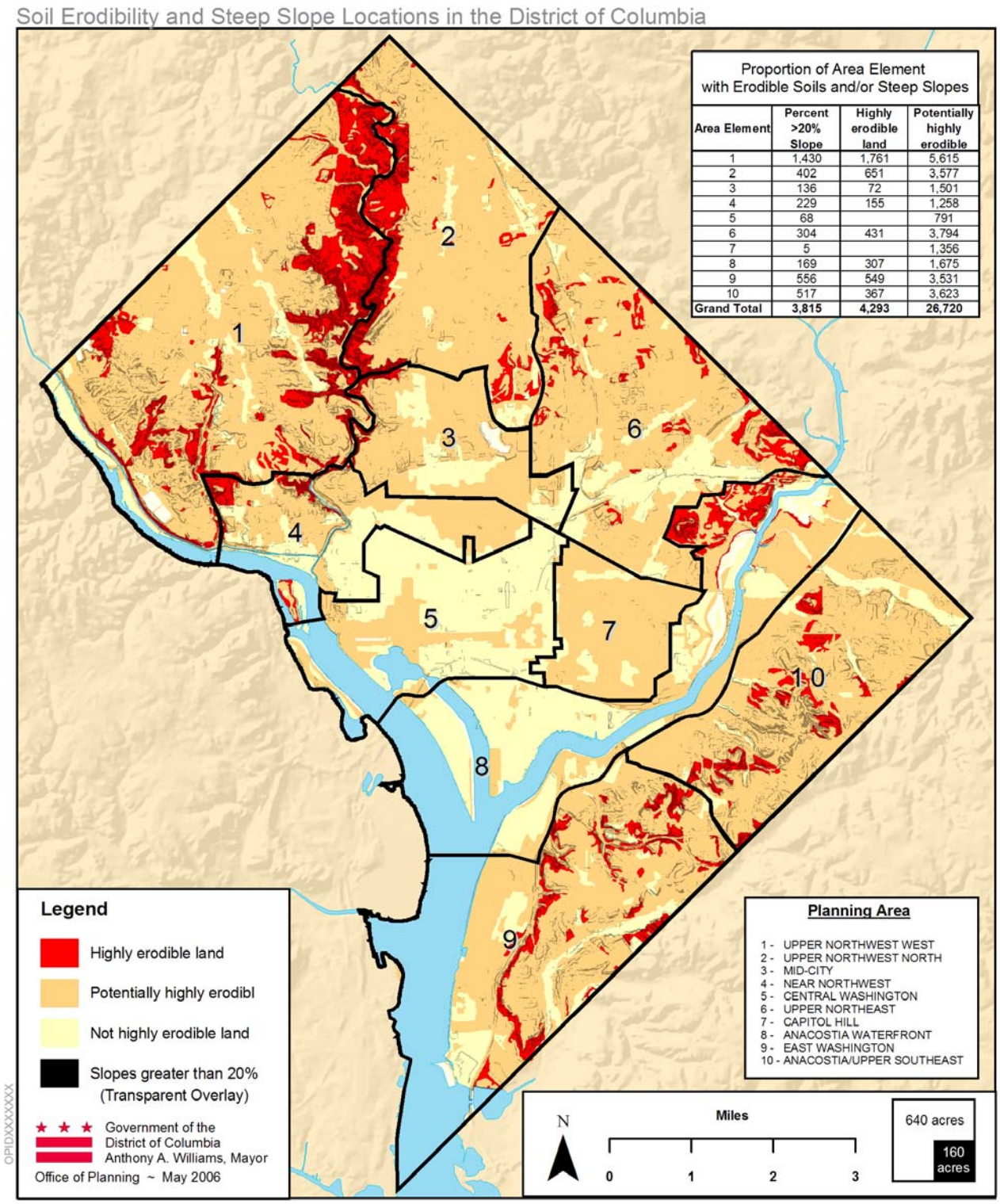


Figure 2-4: Soil Erodibility and Steep Slope Locations in the District of Columbia

Table 2.8: Soil Erosion Categories in the District of Columbia		
Classification	**Acres**	**Proportion of District of Columbia**
Not Highly Erodible Land	8,268	18.7%
Potentially Highly Erodible	26,908	60.9%
Highly Erodible	4,330	9.8%
---	4,654	10.5%

Based on the soil erodibility map presented in **Figure 2.4**, erodible soils are primarily concentrated within areas of topographic variability within Upper Northwest (especially along Rock Creek and within other park lands) as well as within Upper Northeast near the National Arboretum. Erodible soils are also interspersed in the upland areas west of the Anacostia River. Due to the amount of paved surfaces in the Central Washington, Capitol Hill, and Anacostia Waterfront areas, soil erodibility within these areas is generally low.

Few comprehensive surveys of major upland erosional processes in the District have been conducted. One recent study conducted in 2003 evaluated the erosional processes occurring in 87 District parklands (DOH, 2005). This study noted that five of these parks were considered sites with active annual erosion, which can potentially pose safety risks to citizens or potential damage to nearby property. The majority of park areas rated as having the most serious erosion ranking are located near the District Boundary. Two of these parks are located in South East (Hillcrest Recreation Center and Watts Branch Recreation Center), two in the North East (Fort Lincoln Recreation Center and Evans Recreation Center), and one in the North West (Palisades Recreation Center) (DCR 2003).

Stream Bank Stability & Erosion

Stream bank erosion is a result of multiple interrelated factors. The rate at which erosion occurs in stable systems is generally much slower and of a smaller scale than that which occurs in unstable systems. In the District, similar to other urban environments, large amounts of impervious surface in the contributing watershed result in unnaturally high flow volumes during storm events. This stormwater runoff generates significant stream flow volumes and velocities, which can destabilize stream channels and increase sediment production and delivery to downstream areas. Other factors that contribute to stream bank erosion are the clearing of stream bank vegetation, stream bed lowering, or development infill. Stream banks in the District range from unvegetated and highly unstable with great potential for erosion and collapse, to recovering re-vegetated stream banks, to fairly stable and fully-vegetated stream banks.

The District works with the Chesapeake Bay Program's Watershed Commitments Task Force (CWiC) to actively plan and implement stream restoration projects that address stormwater runoff, develop partnerships between multiple land owners, and suggest specific design considerations in urbanized watersheds. The goal of these stream restoration initiatives is to improve degraded habitat, increase diversity and stability of supported biological communities, and reduce downstream sediment and pollutant loading impacts. The CWiC has developed Bay-

wide Aquatic Health Guidelines and recommended actions to ensure the health of stream corridors (Chesapeake Bay Program, 2003b).

2.2.4 TRENDS

Much of the District has been developed, and therefore "urban" soils, composed primarily of disturbed soils and fill, predominate. These soils, once paved over or compacted are no longer fertile or productive, and are not likely to be for the foreseeable future. The distribution of disturbed soils is extensive in the District, and therefore, additional development and construction adds little to reducing the quality or productivity of the District's already degraded soils.

However, with future development, more soils areas will be compacted and/or covered with impervious surface. Although erosion from these areas is generally minimal after the construction phase is completed; the creation of additional impervious surface results in an increase in runoff, and increased water volumes in streams and rivers. The increased water volume results in soil loss due to elevated bank erosion and scouring, and also contributes to the destruction of riparian buffer vegetation as banks become undermined and fail. Additionally, aquifer recharge declines as rainfall is rapidly converted to surface runoff instead of percolating into the soil and entering the groundwater system. Some of the impacts of new and infill development plans may be mitigated though the implementation of BMPs and through stream rehabilitation projects.

2.3 WATER RESOURCES

2.3.1 REGULATORY FRAMEWORK

The regulatory agency in charge of protecting water resources for the District of Columbia is the Department of Health (DOH); however, this responsibility will transfer in 2006 to the new Department of the Environment. DOH adheres to the main objective of the Clean Water Act (CWA), which is to *"restore and maintain the chemical, physical, and biological integrity of the Nation's water."* To help meet these objectives, the District and the States must adopt water quality standards (WQS) for all *"waters of the United States*" within their boundaries. Water quality standards, at a minimum, consist of three major components: 1) designated beneficial uses; 2) narrative or numeric water quality criteria to support each use; and 3) an anti-degradation statement. In addition, the CWA requires frequent reporting on the status of the waters. **Table 2.9** shows the regulatory framework for water resource management and compliance in the District.

Table 2.9: Regulatory Framework for Stormwater Management in the District		
Regulating Agency	**Division**	**Responsibility**
The District Department of Health (DOH), Environmental Health Administration (EHA)	Watershed Protection Division, Sediment and Stormwater Technical Services Branch	• Adheres to main objective of the Clean Water Act (CWA) • Reviews construction and grading plans for stormwater management, erosion and sediment control, and floodplain management. • Implements MS4 permit
The District Department of Public Works	Environmental Services & Solid Waste Management	Implements MS4 permit
District Water & Sewer Authority (DCWASA)	Stormwater Permit Compliance Administration	• Ensures Potable Water Quality • Implements MS4 permit • Collects fees towards the Stormwater Permit Compliance Enterprise Fund
Environmental Protection Agency	NPDES permits	EPA issues NPDES permits and general permits for Municipal Separate Storm Sewer Systems (MS4s) . In August 2004, EPA issued a second permit to the District, primarily for compliance with TMDL's issued by the District's DOH

In 2005, Congress approved several acts of legislation by the governments of Maryland, Virginia, and the District of Columbia in order to improve the region's water quality and reauthorize the Chesapeake Bay Program.

The Chesapeake Bay Restoration Enhancement Act of 2005

This act is an amendment of section 117 of the Clean Water Act. It increases support to local governments in the region while requiring more accountability by federal and state agencies for water quality.

The Chesapeake Bay Watershed Nutrient Removal Assistance Act

This legislation authorizes $132 million annually until 2007 to fund nitrogen removal upgrades at the 310 major sewage treatment plants in the Chesapeake Bay Watershed.

Anacostia Watershed Initiative Act of 2005

This bill amends the Federal Water Pollution Control Act and the Water Resources Development Act of 1992 to provide for the restoration, protection, and enhancement of the environmental integrity, and social and economic benefits of the Anacostia Watershed.

Designated Uses

Designated uses are identified by taking into consideration the use and value of the water body for public water supply; for protection of fish, shellfish, and wildlife; and for recreational, agricultural, industrial, and navigational purposes. The District's Water Quality Standards (§ 1101 of the District of Columbia Municipal Regulations) define five categories of designated water uses which shall be protected, and upon which the development of water quality criteria are based.

The five designated use categories and the corresponding classes defined by the District are presented in **Table 2.10**. These include the protection of primary and secondary contact recreation, as well as aesthetic enjoyment. The maintenance and propagation of aquatic life and the protection of human health related to fish and shellfish consumption are also protected as designated uses of the District's waters. Navigation is also recognized as a designated use category in the District.

Table 2.10 Designated Use Categories for District of Columbia Waters

Designated Use Categories for District of Columbia Waters	Designated Use Classes
Primary contact recreation[1]	A
Secondary contact recreation and aesthetic enjoyment[2]	B
Protection and propagation of fish, shellfish, and wildlife	C
Protection of human health related to consumption of fish and shellfish	D
Navigation	E

[1] Any recreational activities with prolonged and intimate contact by the human body with the water (ingesting water, swimming, diving, water skiing, and surfing).
[2] Any recreational activities with minimal contact by the human body with the water (probability of ingesting water is low, boating, and fishing).

According to the District's Water Quality Standards (DOH, 2003a), "the surface waters of the District should be classified on the basis of their (i) current uses, and (ii) future uses to which the waters will be restored." Surface waters are classified in the following table according to section 1101.2 of the District of Columbia Municipal Regulations. At this moment, none of the waters are meeting the primary contact recreation use designation (**Table 2.11**).

Table 2.11 Classification of the District's Waters		
Surface waters of the District	**Use Classes**	
	Current Use	**Designated Use**
Potomac River	B, C, D, E	A, B, C, D, E
Potomac River tributaries (except as listed below)	B, C, D	A, B, C, D
Battery Kemble Creek	B, C, D	A, B, C, D
C & O Canal	B, C, D, E	A, B, C, D, E
Rock Creek and its tributaries	B, C, D, E	A, B, C, D, E
Tidal Basin	B, C, D, E	A, B, C, D, E
Washington Ship Channel	B, C, D, E	A, B, C, D, E
Oxon Run	B, C, D	A, B, C, D
Anacostia River	B, C, D, E	A, B, C, D, E
Anacostia River tributaries (except as listed below)	B, C, D	A, B, C, D
Hickey Run	B, C, D	B, C, D
Watts Branch	B, C, D	A, B, C, D
Wetland	C, D	C, D

Water Quality Criteria

Water quality criteria are the foundation of the water quality-based pollution control program mandated by the Clean Water Act. The CWA requires the States and the District to adopt water quality criteria with sufficient coverage of parameters and of adequate stringency to protect designated uses. Numeric criteria are relevant when the cause of toxicity is known or for the protection against pollutants with potential human health effects. Narrative criteria (non-numeric) are also issued, and often serve to limit the toxicity or other detrimental impacts of waste discharges on aquatic species and the environment. Specific water quality criteria for the District can be found at http://doh.dc.gov/.

Antidegradation

Antidegradation is designed to prevent deterioration of existing water quality conditions. It is part of the CWA requirement and calls for all existing uses to be protected; for deterioration to be avoided or at least minimized when water quality meets or exceeds standards; and for outstanding waters to be strictly protected. The District's DOH follows a tiered approach to implement antidegradation water quality protection:

- Tier I Protect Existing Uses: Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

- Tier II Maintain "High Quality" Waters: Avoid, or at least hold to a minimum the lowering of quality on waters that currently meet or exceed water quality standards.

- Tier III Protect "Outstanding" Waters: Give strict protection to the most ecologically significant and sensitive, the cleanest, and the most recreationally important waters. Those waters shall be designated Outstanding National Resource Waters (ONRW) and the water quality in the ONRW shall be maintained and protected.

CWA Reporting

DOH submits a report on the District's water quality to the U.S. Environmental Protection Agency (EPA) pursuant to Section 305(b) of the federal Clean Water Act. The Report provides water quality information to the general public and serves as the basis for EPA 's National Water Quality Inventory Report to Congress.

In addition, Section 303(d) of the Clean Water Act requires the District and States to identify waters that do not meet water quality standards. States and the District are required to compile this information in a list and submit the list to EPA for review and approval. This list is known as the Section 303(d) list of impaired waters. As part of this listing process, States and the District are required to prioritize waters/watersheds for future development of Total Maximum Daily Load (TMDL). A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. It is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

In July 2003, EPA promulgated new guidance for the listing of Section 303(d) and 305(b). According to the new guidance, the states are required to categorize all state water into five assessment categories (DOH, 2004):

- In category 1, waters meet all designated uses.
- In category 2, waters meet some of their designated uses, but there is insufficient data to determine if remaining designated uses are met.
- In category 3, waters have insufficient data for determining whether any designated uses are met.
- In category 4, waters are impaired or threatened but a TMDL is not required for following reasons:
- Subcategory 4A: A TMDL has been approved or established by EPA.
- Subcategory 4B: TMDL is not needed, since other pollution controls are expected to result in water quality standard attainment.
- Subcategory 4C: Impairment of the waterbody is not caused by a pollutant.
- In category 5, waters are impaired or threatened and a TMDL is required.

2.3.2 CHARACTERIZATION & INVENTORY

Major Watersheds

Four major watersheds drain the District of Columbia (**Figure 2.5**). A small portion of the District (3%) in its northwestern most corner is drained by Little Falls Branch. This small tributary of the Potomac River is considered part of the larger Potomac River watershed, in Montgomery County (Maryland HUC# 02140202). Immediately to the east of this watershed lies the Rock Creek watershed (Maryland HUC# 02140206) which is the second largest drainage in the District, draining approximately 30% of its area. To the east and south of the Rock Creek watershed is the Anacostia River Watershed (Maryland HUC# 02140205), which drains a majority of the District land area (54%). Lastly, the Oxon Creek watershed (Maryland HUC# 02140204) drains the lands west of the Anacostia River watershed, and accounts for 12% of the District. **Table 2.12** summarizes the watershed areas, their total area within the District, and the proportion of the District drained by each watershed.

Table 2.12 Major watersheds of the District

Name	HUC #[1]	Total Drainage Area (sq. mi.)	Area in District (sq. mi.)	Proportion of Total District Area (Area in District / 69 sq.mi.)[2]
Anacostia River	02140205	182	37	54%
Rock Creek	02140206	82	21	30%
Oxon Creek	02140204	18	8	12%
Potomac River Montgomery Cnty.	02140202	140	2	3%

[1] HUC # Hydrologic Unit Code Number based on Maryland 8 digit subwatershed codes

[2] Proportions add up to less than 100%. Approximately 1% of the District area falls within Potomac River Upper Tidal watershed (02140201).

River and Streams

Several flowing waterbodies begin or pass through the District, all of which feed into the Potomac River (**Figure 2.6**). The portion of the Potomac River falling within the boundaries of the District is it's largest flowing waterbody, which is also tidally influenced up to Little Falls. The Potomac River drainage area at this point is approximately 11,560 square miles and encompasses portions of the states of Virginia, West Virginia, and Maryland (**Table 2.13**).

Table 2.13 Average Flows for the Potomac and Anacostia Rivers and Rock Creek			
	Location	**USGS Unit**	**Flow (cfs)[2]**
Potomac River	DC Little Fall Pump Station, MD	01646500	13666
NW Branch	At Hyattsville, MD	01651000	60
NE Branch	At Riverdale, MD	01649500	103
Anacostia River[1]		-	164
Rock Creek	At Sherril Drive, Washington DC	01648000	73

[1] Flow for Anacostia River is the sum of NW and NE Branch
[2] Flow is based on an average of 10 hydraulic consecutive years from 1994 through 2004
NW Northwest; NE Northeast

The Anacostia River flows along the western side of the District draining into the Potomac near its southernmost border. Its total drainage area is approximately 182 square miles, and the entire length of the Anacostia River (proper) is tidally influenced with a tidal cycle of approximately three feet (DOH, 2003h). The tides move up to the location of the USGS gages on the Northeast (USGS 01649500) and the Northwest Branch (USGS 04651000). Ten small tributaries flow into the Anacostia River (Fort Chaplin Tributary, Fort Davis Tributary, Fort Dupont Creek, Fort Stanton Tributary, Hickey Run, Stickfoot Creek, Nash Run, Popes Branch, and the largest Watts Branch) and eleven small tributaries into the Rock Creek (Fenwick Branch, Portal Branch, Pinehurst Branch, Luzon Branch, Broad Branch, Soapstone Creek, Melvin Hazen Valley Branch, Piney Branch, Klingle Creek, Normanstone Creek, and Dumbarton Oaks).

Rock Creek drains the majority of Northwest DC, and has a total drainage area of approximately 82 square miles. Rock Creek is a free-flowing stream with no dams or regulated sections. It has short residence times for flows and is not tidally influenced (DCWASA, 2002).

Based on average flows of 15 consecutive years from 1989 through 2004, all three rivers show elevated flows throughout the winter and spring, with peak flows at the beginning of spring and lowest flows during the summer between July and September (**Figure 2.7**).

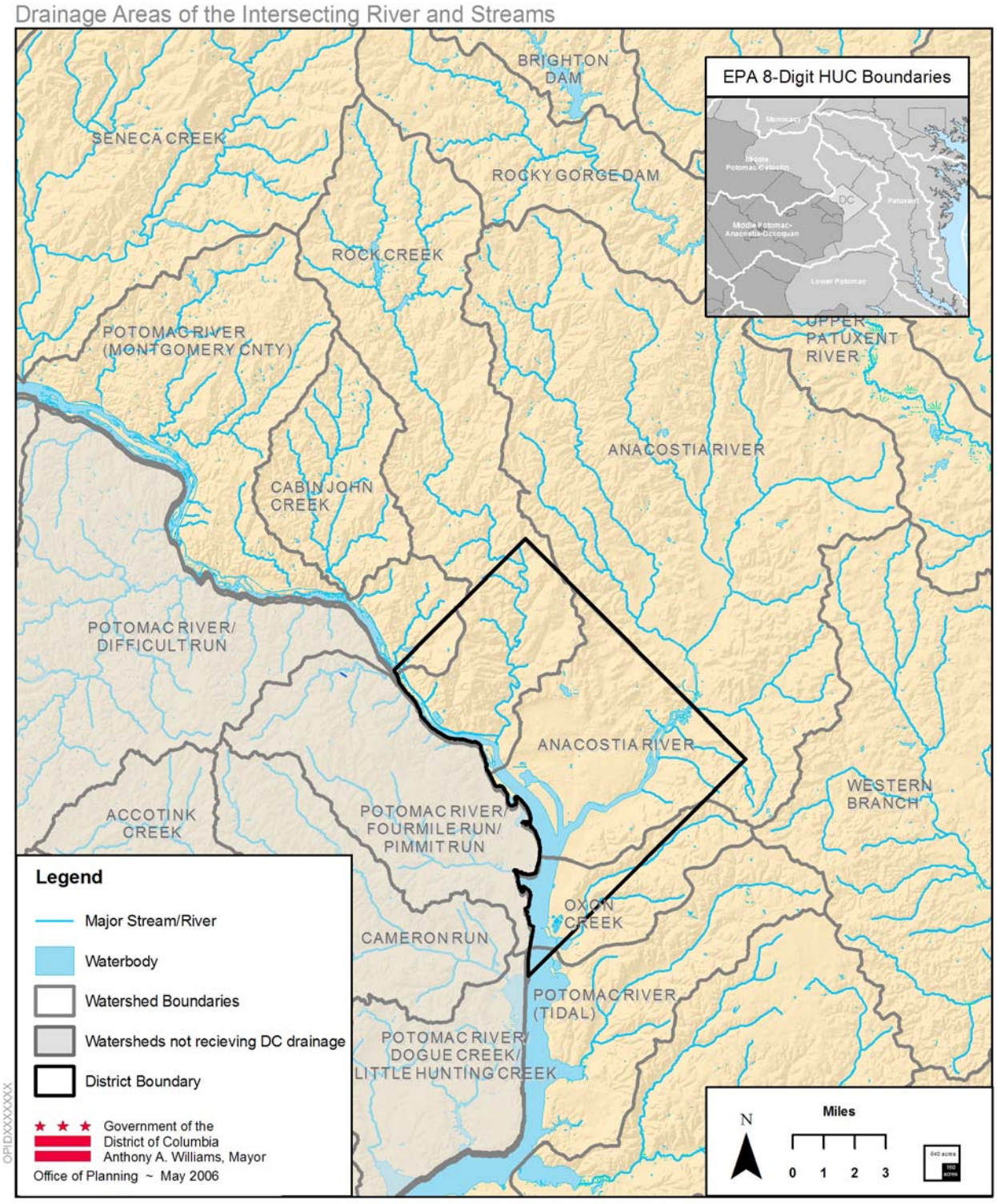


Figure 2.5 Drainage Areas of the Intersecting River and Streams

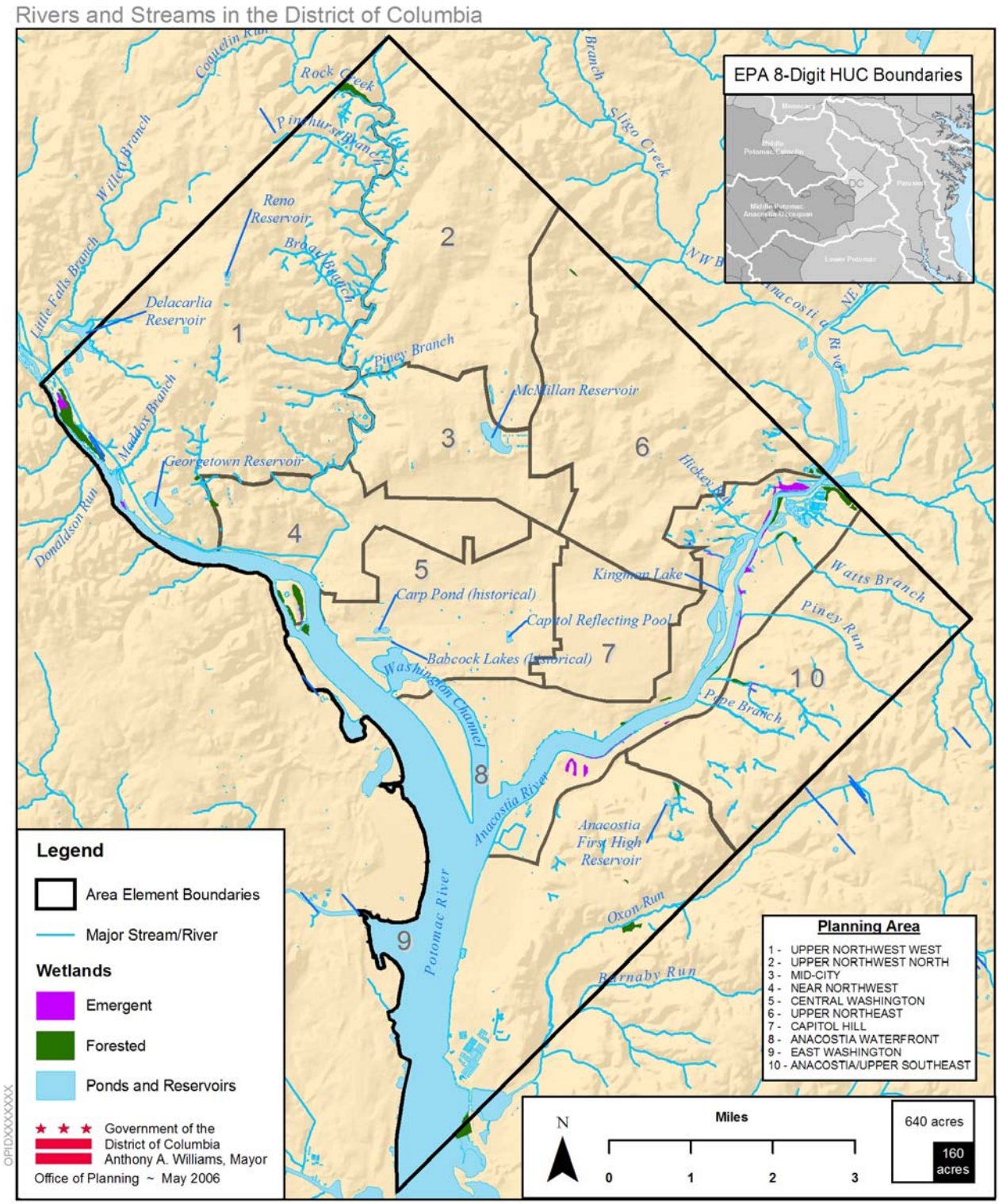


Figure 2.6 Rivers and Streams in the District of Columbia

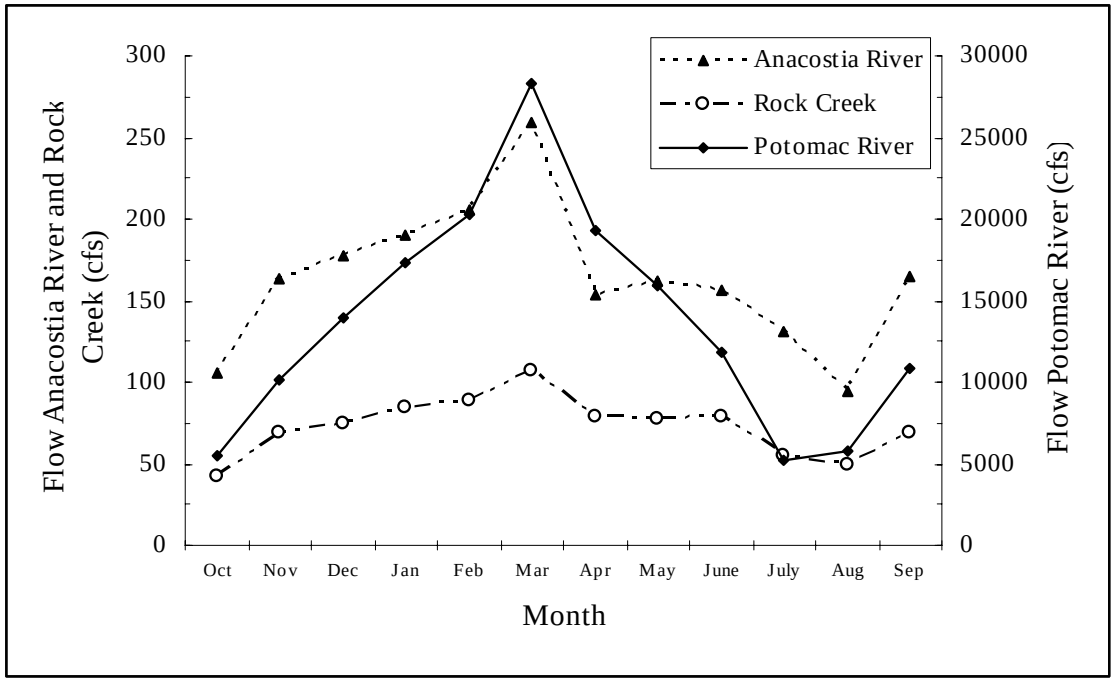


Figure 2.7 Comparison of flow throughout a hydrologic year for the Potomac River, Anacostia River, and Rock Creek

Drinking Water

The District receives its water from the DC Water and Sewer Authority (DC WASA), a water distribution agency which purchases water from the Washington Aqueduct Division of the U.S. Army Corps of Engineers (WAD). WAD withdraws approximately 180 million gallons per day of water from the Potomac River through intakes at Great Falls and Little Falls for residential and commercial uses (DOH, 2002, DC WASA, 2003). Three other water suppliers (Washington Suburban Sanitary Commission, WSSC, Fairfax County Water Authority (FCWA), and the City of Rockville) also withdraw their water from the Potomac River, serving more than 2.8 million customers. Intakes for these suppliers are located upstream of Great Falls (DOH, 2002, DC WASA, 2003).

The water withdrawn by WAD is conveyed by gravity flow and pumps in large conduits to the Delacarlia Reservoir for storage and pre-sedimentation, and from there it is transported for further treatment to the McMillan and Dalecarlia plants. The treatments performed include: filtration for particle removal, fluoridation, pH adjustment, disinfections with chlorine and chloramines. Both treatment facilities process 170 million gallons per day of water on average, with plant capacity between 280 and 320 million gallons per day (DOH, 2002, DC WASA, 2003).

The current average annual water use for all water suppliers in the metro area is approximately 488 million gallons per day. Water withdrawal is lowest in the winter months and highest over the summer when outdoor water uses increase. During droughts when the demand for water is higher than the Potomac flow (mid-July through late October or early November), the three major Washington Metropolitan Area (WMA) suppliers jointly use water from the Jennings

Randolph, Little Seneca Reservoir, Occoquan, and Patuxent reservoirs to augment water supply and maintain adequate flows in the Potomac River (Kame'enui *et al*. 2005).

Groundwater

Groundwater is defined as subsurface water found in the saturated soils and water-bearing bedrock of the earth's surface. The water bearing formation of unconsolidated deposits and fractured zones (cracks and fissures) in bedrock is called an aquifer.

Two physiographic areas are defined in the District. Both areas are divided by the Fall Line, a boundary which separates younger sediments of the Coastal Plain and the older, crystalline rocks of the Piedmont (USGS, 2002, DOH, 2004a).

The semi-consolidated and unconsolidated sediments of the Coastal Plain Province are productive aquifers ("Potomac Aquifer"), with Patapsco and Patuxent Formations the most productive (DOH, 2004a, USGS, 2002). The lower part of the Potomac Aquifer is an interstate confined aquifer which has supplied water to industry, agriculture, and the District's public for two centuries. The confining unit of the Potomac Aquifer consists of clay and sandy clay (DC VVMRC, 1992).

In contrast, the Piedmont Province (Crystalline-rock aquifers) has only a moderate extent of water bearing formations in limited areas where a mantle of weathered materials covers the rock, or within cracks and fissures (USGS, 2002, DOH, 2004a).

The water in the District's aquifer originates from precipitation. Approximately one quarter (10 inches) of the average annual precipitation (40 inches, based on data from 1951 through 1980) recharges the District's aquifer (DC VVMRC, 1992, USGS, 2002).

Although the District of Columbia obtains its drinking water entirely from the Potomac River, groundwater in the District is protected by D.C.'s Department of Health for beneficial uses, including surface water recharge, drinking water in other jurisdictions, and potential future use as a raw drinking water source. In order to guarantee the best protection of the groundwater in the District, DOH classified all ground waters as Class G1 until sufficient information is obtained to determine otherwise. Class G1 is groundwater that is highly vulnerable to contamination, located in recharge areas of drinking water aquifers of adjacent jurisdictions, is hydrologically connected to surface waters of the District, and discharges to a sensitive ecological system that supports a unique habitat (DOH, 2003b).

2.3.3 PLANNING ISSUES

Impaired Waters

A stream or water body that does not meet applicable water quality standards is considered 'impaired'. The Clean Water Act (CWA) Section 303(d) requires all States to list all impaired water bodies that are not expected to meet water quality standards, even after the application of technology based pollution controls required by the CWA. In order to return the water to a condition that meets water quality standards, the State and/or EPA must develop a Total Maximum Daily Load (TMDL) for each water body on the list. A TMDL identifies allowable

pollutant loads to a water body from both point and non-point sources that will prevent factors contributing to a violation of water quality standards. Listed water bodies are given one of five attainment categories which reflect the water quality status (See Table 2.14). As reported in the District's 2004 303(d) list, there are 51 impaired water bodies in which 13 are categorized in subcategory 4A and the remaining 38 in category 5. The impaired waterbody categories are listed in **Table 2.15**.

Current 303(d) list determinations were made based on ambient water quality monitoring data from 1997 through 2002, municipal separate storm sewer system monitoring data from 2001 to 2002, biological data collected between 2002 and 2003, and the DC Fish Tissue Contamination Report from 2001. Waterbodies on the district's 303(d) list are impaired due to pollutants such as toxics, sediments, pathogens, organic enrichment, and low dissolved oxygen concentrations. In addition, impairment is also caused by high flow triggered by excessive runoff, resulting in eroding riverbeds and shorelines of several of the listed waterbodies (DOH, 2003d). All monitored waterbodies do not support primary contact recreation (DOH, 2004a).

Table 2.14 TMDL Attainment Categories & Descriptions

1	Waters attaining all designated uses
2	Waters were attaining all of the designated uses for which they were monitored
3	Insufficient data to make a determination as to attainment of use
4	Waters which were impaired but not requiring a TMDL
4a	TMDL has been approved or established by EPA
4b	Expected to meet all designated uses within a reasonable timeframe
4c	Not impaired by a pollutant
5	Waters that were impaired and required a TMDL

Waterbody impairments in the District are caused by sources located both within the District and those located outside of the District transported through major rivers (Potomac River, Anacostia River, Rock Creek, and Oxon Creek). Pollutant loads from outside the District are the major contributor to the total load of pollutants observed in the District. Within the District, the greatest source of pollutants stesms form Combined Sewer Overflows (CSOs). Outside of the District, CSOs are minor or not present, and non-point sources are the major contributor of pollutants. Municipal point sources only play a role in the Potomac River from Blue Plains Wastewater Treatment Plant (DOH 2003d).

Table 2.15 Impaired Segments of Streams for Category 4A and 5										
Category 4A										
Waterbody	**Drainage Area**	**Bacteria**	**BOD[1]**	**Dissolved Oxygen**	**Fecal Coliform**	**Metals[2]**	**Oil and Grease**	**Organics[3]**	**pH**	**TSS[4]**
Watts Branch	Anacostia River	✓						✓		✓
Kingman Lake	Anacostia River	✓				✓	✓	✓		
Fort DuPont Creek	Anacostia River	✓				✓				
Fort Davis Tributary	Anacostia River	✓				✓				
Fort Stanton Tributary	Anacostia River	✓				✓		✓		
Fort Chaplin Tributary	Anacostia River	✓				✓				
Popes Branch	Anacostia River	✓				✓		✓		
Texas Avenue Tributary	Anacostia River	✓				✓		✓		
Rock Creek	Rock Creek	✓				✓		✓		
Anacostia River	Anacostia River	✓	✓			✓	✓	✓		✓
Category 5										
Nash Run	Anacostia River	✓				✓		✓		
Potomac River	Potomac River	✓						✓	✓	
Oxon Run	Oxon Run	✓				✓		✓		
Washington Ship Channel	Potomac River	✓						✓	✓	
Battery Kemble Creek	Potomac River	✓				✓				
Foundry Branch	Rock Creek	✓		✓		✓				
Broad Branch	Rock Creek							✓		
Dumbarton Oaks	Rock Creek				✓			✓		
Fenwick Branch	Rock Creek				✓			✓		
Klingle Valley Creek	Rock Creek				✓			✓		
Luzon Branch	Rock Creek				✓			✓		
Melvin Hazen Valley Branch	Rock Creek				✓					
Normanstone Creek	Rock Creek				✓			✓		
Pinehurst Branch	Rock Creek				✓			✓		
Portal Branch	Rock Creek				✓			✓		
Piney Branch	Rock Creek				✓	✓		✓		
Soapstone Creek	Rock Creek				✓			✓		
Dalecarlia Tributary	Potomac River	✓						✓		
Tidal Basin	Potomac River	✓						✓	✓	
Hickey Run	Anacostia River	✓						✓		
Chesapeake and Ohio Canal	Potomac River	✓								

[1] BOD Biochemical Oxygen Demand

[2] Metals Arsenic, Copper, Lead, and Zinc

[3] Organics Chlordane, DDD, DDE, DDT, Dieldrin, Dioxin, Heptachlor Epoxide, PAH1, PAH2, and PAH3

[4] TSS Total Suspended Solids

Potomac River Impairments

The entire Potomac River in the District is listed for varying impairments and separated into three sections; upper, middle, and lower. All three sections are listed for bacteria and organics, and the middle section is listed for pH. Although not listed, the upper and lower sections also showed occasional violations for pH, and the middle section for dissolved oxygen. In addition, the upper section had observed toxics in the sediment and elevated levels of contaminants such as Chlordane and PCBs (Poly Chlorinated Biphenyls) in fish sampled tissues. For all sections, the Public Health Advisory urges non-consumption of catfish, carp, or eel and limited consumption of other fish caught in District's waters (DOH, 2004a).

The cause of the impairments in the Potomac River sections are a combination of pollutants originating from the upstream drainage area of the Potomac River, its major tributaries in the District (Rock Creek and Anacostia River), diffuse sources from the Potomac River shore line, and the only POTW (Publicly Owned Treatment Works) point source in the District, Blue Plains Wastewater Treatment Plant. The upstream drainage area of the Potomac River delivers elevated concentrations of sediments, nutrients (nitrate and ortho-phosphorus), fecal coliform, organics (pesticides), and heavy metals (lead and mercury). Violations for fecal coliform and pesticides were usually found under wet conditions in the District's sections of the Potomac River (Ator, Scott W. *et al.*, 1998, DOH, 2002).

DOH implemented a watershed model to estimate annual average loads for sediments, nitrogen, phosphorus, fecal coliform, and pesticides. The results of the modeling suggested that agriculture and pasture, both non-point sources, are by far the major sources for these pollutants; point sources only contribute to nutrient loads. Furthermore, most pollutants have only minor impact on the Potomac River because of dilution. Fecal coliform violates the criterion only under storm flow conditions downstream of the source. Atrazine concentrations are moderately low, violating the criterion only under high flow conditions when excessive erosion due to severe rain storm event follows an atrazine application on fields (DOH, 2002).

The watershed model estimations are similar to conclusions drawn by USGS in 1998 (Ator *et al.*, 1998). Based on water quality data from the Potomac River between 1992 and 1995, USGS concluded that in most cases nutrients do not pose a threat to human life or wildlife. Pesticides were found mostly in agricultural areas of the Potomac River Basin and some urban streams, but they were rarely at levels threatening to aquatic life. In particular, during spring and early summer floods, elevated concentrations of pesticides can be encountered in the District violating the criteria, including atrazine. The USGS study also found the presence of organic contaminants (chlorinated organic compounds such as PCP and chlordane) and heavy metals (mercury and lead) in sediments at critical concentration for aquatic life.

Rock Creek Impairments

Rock Creek feeds into the Potomac River and is listed for bacteria, metals, and organics. Most of its tributaries are also listed for organics and metals. The organic contaminants include chlordane, DDD, DDE, DDT, dieldrin, heptachlor epoxide, PAH1, PAH2, and PAH3 and the

metals arsenic, copper, lead, and zinc. Public Health Advisory does not support fish consumption in Rock Creek (DOH 2004c and DOH 2004d).

Although the entire length of the Rock Creek in the District is lined with publicly owned park land covering approximately 17 % of the Rock Creek watershed (9.3 miles long and up to one mile wide), Rock Creek shows degradation due to riverbed scouring, bank erosion, and contamination of the sediments and water. The cause of its degradation has several sources. Agricultural and urban runoff originating outside of the District provide a combined source of high flows, sediments, and pollutant loads. Inside of the District, most areas of Rock Creek drainage area have been urbanized, resulting in an increase of impervious areas. In addition, large sections of Rock Creek's tributaries have been rerouted into artificial channels or conveyed via underground pipes, thus drastically minimizing flow travel times, and destroying aquatic communities. The increase in impervious areas and channelization of many Rock Creek's tributaries has resulted in increased storm water and sanitary sewage overflow discharges. Approximately 29 CSOs and 188 other outfalls (storm sewer, private owned drains) have been discharging into the Rock Creek (CH2M Hill, 1979, DOH, 2003e, 2004b).

Anacostia River Impairments

The Anacostia River is the largest tributary of the Potomac River within the District. The section of the Anacostia River in the District is listed for bacteria, Biochemical Oxygen Demand (BOD), metals, oil and grease, organics, and Total Suspended Sediments. The Anacostia River showed occasional violations for dissolved oxygen. There is a Public Health Advisory urging non-consumption of catfish, carp, and eel and limited consumption of other fish caught in the District's waters (DOH, 2004a).

The causes of the impairments are similar to the ones in Rock Creek. CSOs and non-point sources are the major sources causing the impairments. The upstream section of the Anacostia River is mostly channelized and drains from a heavily urbanized area. The pollutants are quickly transported to the tidal section of the Anacostia River where they accumulate and remain on average for approximately 40 days due to poor flushing. The accumulation of oxidizable organic material can cause severe dissolved oxygen depletion and fish kills during summer months. The Anacostia River in the District also receives large loads of sediments, originating from active surface mines, abandoned sand and gravel mines and stream bank erosion. The River therefore shows high turbidity. Algal blooms have never been reported presumably because of limited light penetration through the water column (DOH, 2003F, 2004b).

Potential Causes of Impairment

Sources contributing to water quality impairment in the District are varied and consist of point source pollution which is discharged from the region's sewage treatment plants and combined sewer overflows; and non-point source pollution produced principally from storm water and agricultural runoff.

Point Source Dischargers

Point source pollution originates from a specific source, such as a pipe, and can easily be identified. In Washington DC, major point source pollution is discharged from the region's sewage treatment plants and combined sewer overflows. Existing older stormwater management systems in the District of Columbia are not always adequate to handle runoff caused by extensive impervious surfaces.

The Federal Water Pollution Control Act (FWPCA) Amendments of 1972 in the Clean Water Act created the National Pollutant Discharge Elimination System (NPDES) permit program. The NPDES permit program regulates wastewater discharging into waters of the United States. Point sources in the NPDES permit program are defined as discharges from pipes and conduits from publicly owned treatment works (POTWs), industrial facilities, and discharges associated with urban runoff (EPA, 1997, 2005).

Municipal sources (POTWs) predominantly obtain domestic sewage from residential and commercial customers. They apply to specific NPDES programs such as the National Pretreatment Program, Municipal Sewage Sludge Program, Combined Sewer Overflows (CSOs), the Municipal Storm Water Program. Non-municipal sources obtain wastewater from industrial and commercial facilities. They also apply to specific NPDES programs such as the Process Wastewater Discharges, Non-Process Wastewater Discharges, and the Industrial Storm Water Program (U.S. EPA 1997).

The NPDES permit program covers technology-based limits, ability of the discharger to treat wastewater, and water quality-based limits when technology-based limits are not able to protect the waterbody (U.S. EPA 1997). The NPDES permit program in the District is administered by EPA, Region III. Final NPDES regulations are promulgated by U.S. EPA in the Code of Federal Regulations every year (DOH 2004a, U.S. EPA 2005). **Table 2.16** lists the NPDES dischargers in the District and **Figure 2.8** shows the location of these facilities.

The NPDES permit program applies to all three watersheds in the District of Columbia (Anacostia River, Rock Creek, and the Potomac River) and issues Municipal Separate Storm Sewer System (MS4) and POTW permits (EPA, 2005). On November 16, 1990, EPA issued permit requirements for its Phase I storm water program for medium and large MS4s. The Phase I storm water program applies to storm water discharges associated with industrial activities and from municipal separate storm sewer systems located in municipalities serving a population of 100,000 or more (EPA, 1996). Storm water is a major problem in the District and therefore has been given high priority for issuing MS4 and POTWs permits (EPA, 2005).

In January of 2001, the District City Council enacted the Stormwater Permit Compliance Amendment Act of 2000 which allocated responsibility of implementing the MS4 permit to the DOH, DPW, and WASA. The Department of Transportation was added later. Among other things, the Act created the Stormwater Permit Compliance Administration within WASA to coordinate agency activities necessary to meet the permit requirement. It also established the Stormwater Permit Compliance Enterprise Fund to provide funds for compliance with the

permit. WASA collects the stormwater fee along with the fee for water and sewer service and manages the fund.

The Blue Plains Wastewater Treatment Plant is the largest discharger in the District with a treatment capacity of 370 MGD and a peak capacity of 1,076 MGD. In addition to primary and secondary treatment, it provides nutrient removal, filtration, and disinfection. In fact, the District handles its wastewater and peak storm water flows from over two million people including 68 significant industrial users by the Blue Plains Wastewater Treatment Plant. Blue Plains has a peak full-treatment capacity of 740 mgd for four hours during storm events and then is reduced to 511 mgd to protect the biological treatment process. The additional flows of up to 336 mgd exceeding the treatment capacity of the plant receive excess flow treatment, consisting of screening, grit removal, primary treatment, and disinfection before discharge to the Potomac River.

Table 2.16 Dischargers in Washington DC (as of December 14, 2005)

NPDES Permit #	Location Name	Flow rate (MGD)	Receiving Waters	Type of Ownership
DC0000019	Washington Aqueduct	1.00	Potomac River	Federal
DC0000035	GSA - (West Heating Plant)	0.15	Rock Creek	Federal
DC0000051	Ameraga Hess Corp	0.016	Anacostia River	Private
DC0000094	Pepco - Benning	370	Anacostia River	Private
DC0000141	Washington Navy Yard	5000	Anacostia River	Federal
DC0000159	Anacostia Naval Station	2.01	Anacostia River	Federal
DC0000167	National Gallery of Art	4723	Washington Ship Channel	Federal
DC0000175	Super Concrete Corp.	0.008	Anacostia River	Private
DC0000191	CTIDC	3150	Anacostia River	Private
DC0000221	Government of the DC	4453	Potomac Riv. Anacostia Riv. and Tributary.	Public
DC0000248	JFK Center for Performing Arts	1800	Potomac River	Public
DC0000299	Southeast Federal Center	0.0001	Anacostia River	Federal
DC0000337	WMATA-Mississippi Ave DPS	0.0072	Oxon River	Public
DC0021199	WASA (Blue Plains)	370	Potomac Anacostia and Piney Rivers	Public
DC0022004	Potomac River Generating Station	448	Potomac River	Private

Source: EPA, Permit Compliance System Data Element Dictionary, June 2, 1997

Permits for stormwater release or water used for cooling have been issued for the National Gallery, Kennedy Center, and Government of the District, and Navy Yard. Therefore, their permitted flow rates are higher than other dischargers in the District.

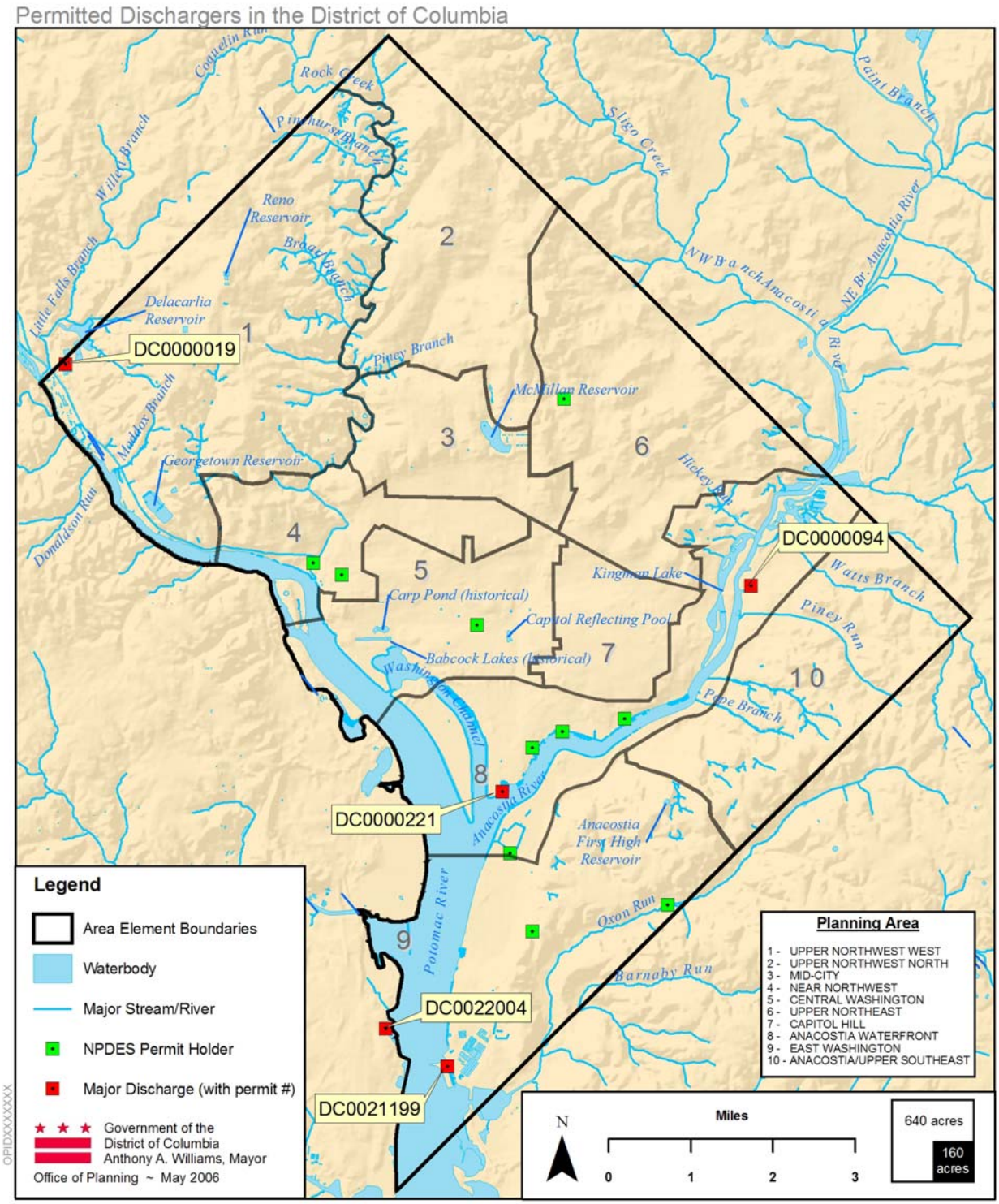


Figure 2.8 Permitted Dischargers in the District of Columbia.